American Machinist

OCTOBER 21, 1957 PRICE 75 CENTS

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

The Impact of AUTOMATION

A SPECIAL REPORT, page 165

Welding titanium in argon-filled bubble at Solar—see page 2

METAL SHOW ISSUE

Precision toolmaking: key to shell molding
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Squirt gun welds dissimilar metals,
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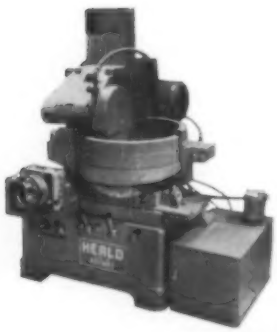
Large work? Low RMS finish? Here's a shining example.



The 30″ Heald Model 361 Rotary does an outstanding surface grinding job

Take this case for instance. The column-type rotary Model 361-30″ is designed to precision surface grind relatively large work. The wheel grinds on its periphery, producing a concentric finish highly desirable in certain applications. The 361 is now available with either a 24″ or 30″ magnetic chuck, and can easily handle work of the size shown above. This piece has a 2-4 R.M.S. finish and a flatness of .0001 in 30″. Send for Bulletin 2-361-1.

IT PAYS TO COME TO HEALD!

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American Machinist
METALWORKING PRODUCTION

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SPECIAL REPORT NUMBER 451

The impact of automation—a nine-year evaluation . . . A detailed study of automation: what it is, where it came from, where it is going—published on the ninth anniversary of the first appearance of the word. *By the editors of American Machinist.* 165

REFERENCE BOOK SHEETS

How to check surface plates I, II, III . . . You can use an auto-collimator to measure deviations from a planed surface and plot contour profiles. 183

American Machinist chips

Metal Show Issue... This year the National Metal Congress and Exposition will be held at the Amphitheatre in Chicago, November 4 to 8. It looks like the biggest yet in this annual series of shows. Because there will be more exhibits than ever, you will find our Show-in-Print section, page 200, even more useful than usual. As always, this section describes only the equipment that will be brand new at the show this year, so you can make a note of "must see" items. Of course, you'll also want to see much equipment that we've already described in previous issues and to make that easier, we have put the floor plans and list of exhibitors on a convenient fold-out insert.

What is Automation?... Today is the ninth birthday of the word automation. It was on Oct 21, 1948 that American Machinist reported Del Harder's brainchild to the metalworking world. To mark the occasion we have a full-scale study of the impact of automation. You will find here a study of what automation really is, of how it is used today, and of how extensive it is likely to become.

To evaluate automation, Andy Ashburn, Rupert Le Grand, Bill Stocker, George De Groat, and Tom Johnson put in weeks of work (and hours of argument). To their experience in reporting automation, they added a survey covering 10% of Metalworking and scores of interviews with men in industry. Whether people are for or against automation, their opinions provide clear pictures of trends; much food for thought. The result should go far to give you perspective on this explosive development. See page 168.

Welding Pair... Two developments in welding will be found in separate articles in this issue. The lead article, page 133, shows how Solar Aircraft is learning to apply production methods to aircraft work. And a technique to combine stainless and alloy steels in a single weldment is described on page 146.

Coming... *AM* for November 4 will provide the next part in our series on tooling for the '58 cars. There will be a detailed report on the programming of machine tools for numerical control. You'll find an article on missile manufacture, another in our series on modern management for the small shop, and several other articles of interest.

Cover...

Argon-filled plastic bubble protects titanium from contamination during welding. The welding chamber was designed at Solar Aircraft. Welding techniques at this plant are described in the article on page 133

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index. American Machinist publishes its own annual index; this is available on request to the editor.

American Machinist, published bi-weekly, with an additional issue in mid-September, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder.

EXECUTIVE, EDITORIAL, CIRCULATION, ADVERTISING and PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd St, New York 36, NY. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions are solicited only from production executives and engineers in the metalworking industries. **Position and company connection must be indicated on subscription orders.**

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United States subscription rate for individuals in the field of the publication $5.00 per year, single copies 75 cents, foreign $25.00 per year, payable in advance. Second-class mail privileges authorized at New York, NY. Printed in USA. Title registered in U S Patent Office.

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Spur gear

Index plate

Retaining ring

How one machine hardens them all *without distortion*

You can quench any part quickly from a hot, plastic state without warpage or distortion when you work with Gleason Quenching Presses.

Since no straightening operation is necessary after hardening you save time and make a definite advance in quality control. Experience shows there is much less residual stress in non-straightened parts.

A button is pressed and the automatic quenching cycle is started. The lower die is swung back into the quenching position and the upper die descends rapidly, aligning the part while it is still in the plastic state.

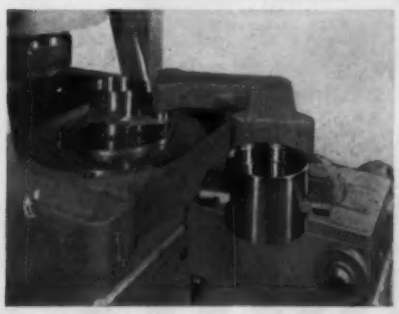
Carefully controlled metallurgically correct oil circulation cools and hardens the part uniformly to preset rates.

The two dies align the part throughout cooling, allowing the part its normal contraction but keeping it true. After the quench, the part is swung out for removal.

As shown in the photograph at the left, Gleason Quenching Presses can be arranged with a completely automatic load and unload unit.

You can harden *any* part, regardless of shape, with this method. There are three presses accommodating parts up to 36″ diameter. Still another Gleason Press automatically hardens and straightens shafts and similar parts up to 4″ in diameter and 40″ long.

Write for literature on the presses. And for recommendations on the press and dies that best fit your products, send us blueprints.



The Gleason Nos. 16 and 26 Quenching Presses can be arranged with the load and unload unit. This unit makes it possible to speed production and reduce labor requirements.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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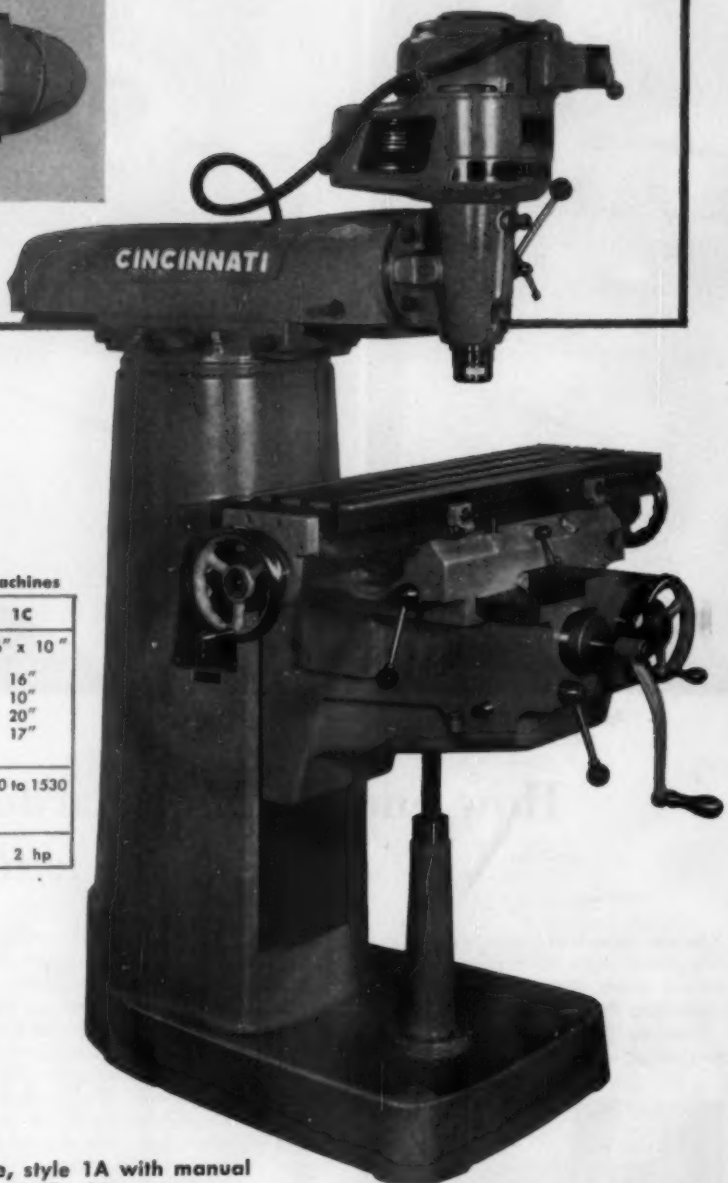
Heavy Duty Head, style 1C Toolmaster Milling Machine; 2 hp spindle drive motor.

Brief Specs, CINCINNATI® Toolmaster Milling Machines

Style	1A	1B	1C
table working surface	36" x 10"	36" x 10"	36" x 10"
range: longitudinal	16"	16"	16"
cross—saddle	10"	10"	10"
—ram	17½"	17½"	20"
vertical—knee	17"	17"	17"
—quill	3½"	3½"	
8 spindle speeds, rpm (choice of 3 series for 1A and 1B)	108 to 2825 140 to 3800 215 to 5650	108 to 2825 140 to 3800 215 to 5650	100 to 1530
spindle drive	¾ or 1 hp	¾ or 1 hp	2 hp



Toolmaster Milling Machine, style 1A with manual feed to quill. ¾ hp or 1 hp spindle drive motor.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • SPECIAL MACHINE

Toolmaster Milling Machines

. . . stretch your machine tool budget

Here's one way to by-pass the "tight money" squeeze on new tool and die shop equipment . . . install Toolmasters to handle the light duty milling operations. You will be highly pleased with Toolmaster performance; the low price tag; their big-machine features; their versatility. ¶ The knee is extra wide and square gibbed . . . graduated dials are the kind operators like, large and easy to read . . . an anti-backlash device on the table feed screw smooths out the cutting action . . . oil-shot lubrication extends the productive life span of the machine . . . electrical controls are built-in . . . a fine variety of attachments are available. ¶ Would you like to have more information? We will promptly forward our attractive Toolmaster catalog, No. M-1870-4. Brief specs in Sweet's Machine Tool File.

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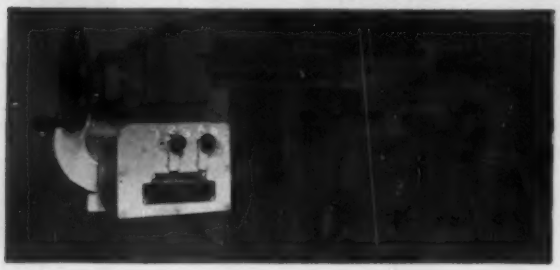
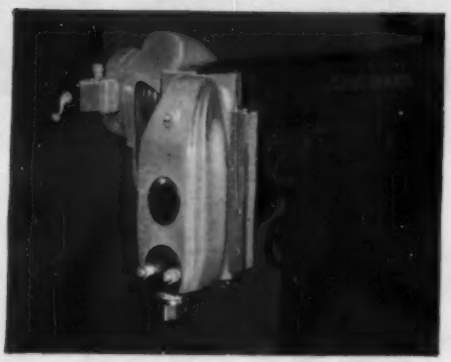
CINCINNATI 9, OHIO

Index Head and Tailstock. 40 to 1 ratio. Indexes same numbers as conventional Cincinnati Dividing Head.



Power Feed to Table. Nine feed rates, ¾" to 15" per minute. Power feed to saddle also available.

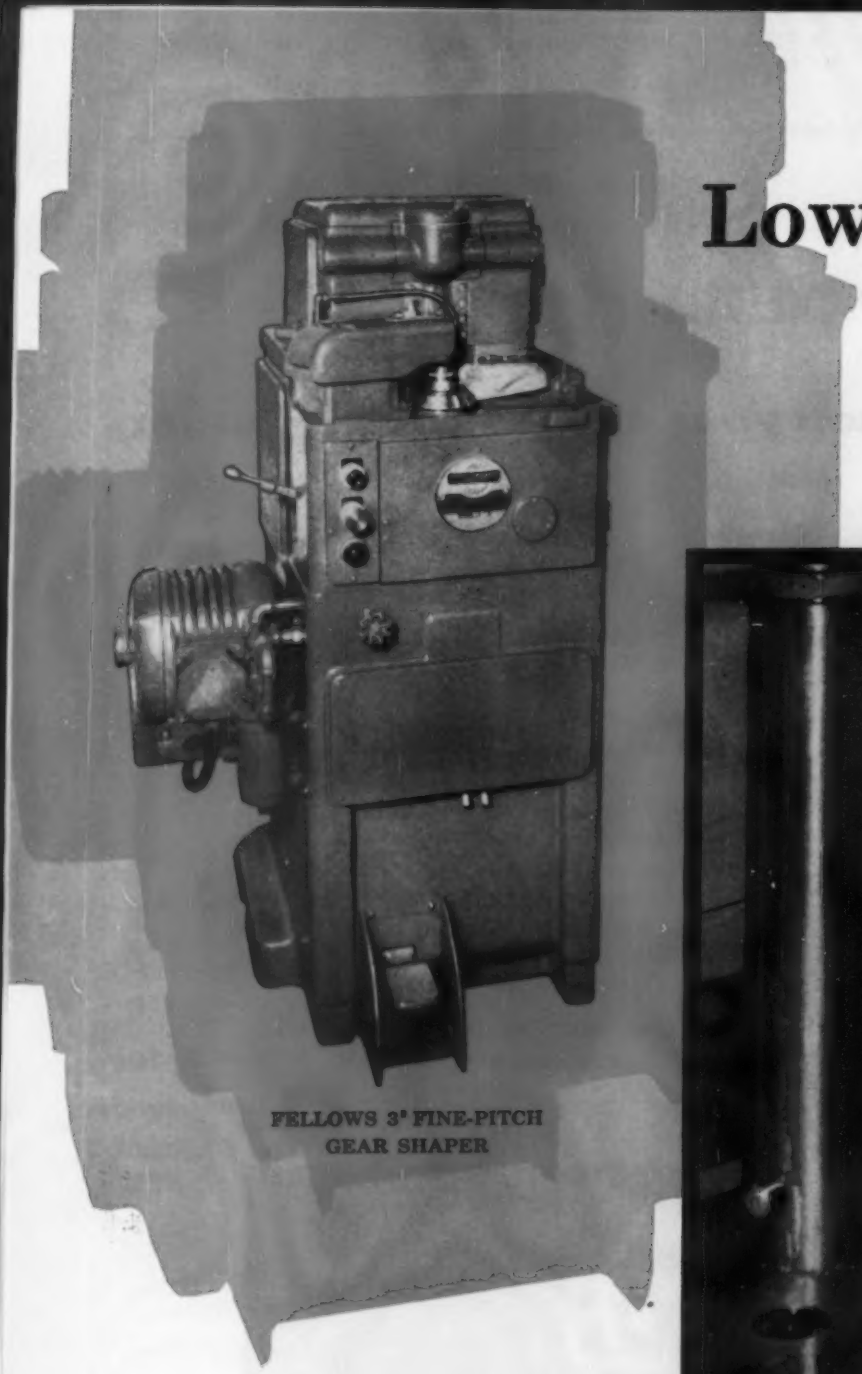


Shaping Attachment. Mounts on rear end of overarm. 0 to 4" stroke. Individual ½ hp drive.

TOOLS • METAL FORMING MACHINES • HARDENING MACHINES • CUTTING FLUID • GRINDING WHEELS

Lowers Pinion

WITH FELLOWS



FELLOWS 3' FINE-PITCH
GEAR SHAPER

Speed and accuracy of the new 3' machine increased production of this pinion from 55 per hour to 120.

THE
PRECISION
LINE

Production Cost from 16.9¢ to 6¢ each!

FINE-PITCH PRODUCTION EQUIPMENT

Fellows No. 4 Fine-Pitch Red Liner Inspection Instrument gives proof of accuracy.

Here's an example that shows how Fellows machines pay off in lowered gear production costs. This small pinion is manufactured for a major instrument maker on a Fellows 3" Fine-Pitch Gear Shaper.

Production is 120 pinions per hour, more than twice the production of previous machines. In addition, pieces are automatically deburred, eliminating an operation. *Result:* the cost per pinion is 10.9 cents lower than before!

Fellows 3" Fine-Pitch Gear Shaper cuts within close tolerances at speeds up to 2,000 strokes per minute. The Fellows No. 4 Fine-Pitch Red Liner inspection instrument gives chart-recorded, permanent proof of the accuracy of the product.

For full information about the Fellows Precision Line of gear production equipment—from 1/16" P.D. to 120" P.D.—contact your Fellows representative. Write, wire, or phone any Fellows office.

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Fellows *Gear Production Equipment*

why buy 2 when

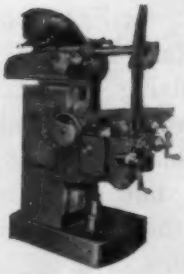
No. 16S — The most versatile miller available — features the quill type adjustable cutterhead that permits horizontal, angular and vertical milling plus boring and drilling. Table: 40½" x 10"; Quill Travel: 4"; Quill Power Feeds: .0015; .003; .006; Cutterhead Spindle Motor: 2 HP; Speeds: 110 to 3600.

VAN NORMAN MACHINE

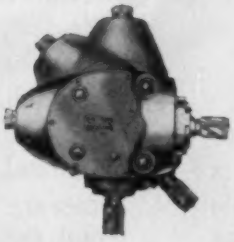
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

ONE will do... when it's a VAN NORMAN Ram type miller

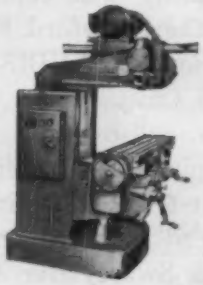
A single investment in ONE Van Norman ram type miller gives you the equivalent of two single purpose machines plus attachments. And at a much lower cost.



No. 16M — a heavy duty miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20½"; 3 HP Cutterhead Spindle Motor; Speeds: 50 to 2000.



This adjustable cutterhead, on the Van Norman 16L & 16M, gives you two millers in one. It enables you to do horizontal, angular or vertical milling, minimizes work reset-ups, cuts idle machine time and tooling costs.



No. 16L — designed to increase production and cut costs in toolrooms, machine shops, pattern shops and on production lines. Table: 40½" x 10"; Ram Travel: 20½"; Cutterhead Motor: 2 HP; Speeds 84 to 2760.

Get complete details on the Van Norman 16S, 16L, and 16M today. Write, wire or telephone for catalog.

COMPANY

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Don't wait . . . for extra profit install a Van Norman machine now! They are available on several purchase plans . . . Outright sale . . . On conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

....threading stainless steel on bar automatic

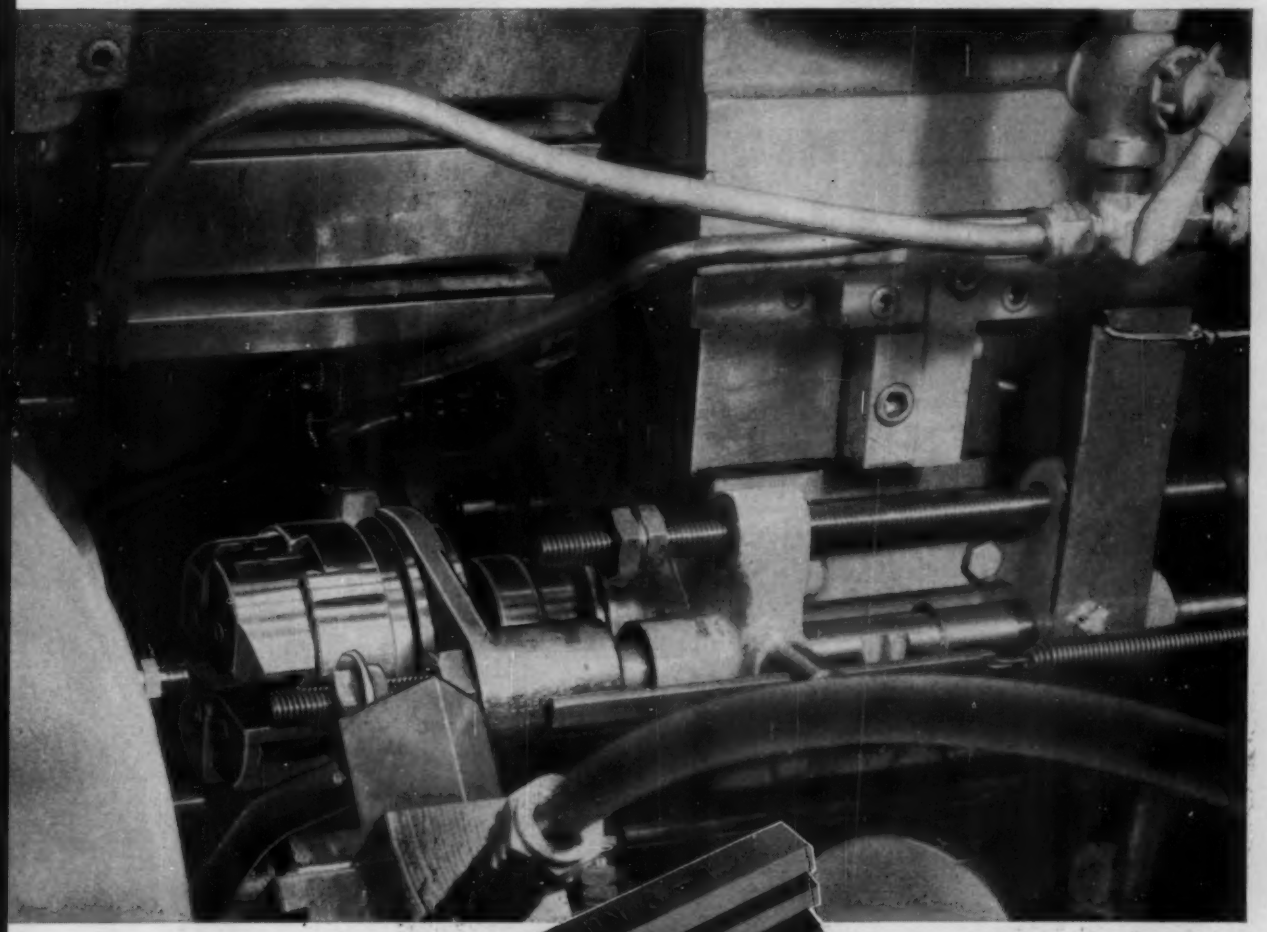
A LANDEX Hardened and Ground Die Head has maintained exceptional chaser life threading male connector tube fittings at the Crawford Fitting Co., exclusive user of LANDIS Equipment in Cleveland, Ohio.

7/16" 20 pitch UNF threads were cut to Class 3 fit from 316 stainless steel by a 7LLL Head mounted on a six-spindle Warner & Swasey Bar Automatic. 144 pieces per hour were threaded 5/16" long within 3/32" of a shoulder at 19 to 20 SFM. 4500 pieces were produced between chaser grinds using 30° short throat chasers.

This outstanding tool life is the result of basic chaser design and over 50 years of LANDIS research and experience in manufacture and hardening. For example, to ensure satisfactory die life, chasers are given special hardening when workpiece design or material specifications so indicate.

Long life between grinds, as illustrated here at the Crawford Fitting Co., is one reason why the use of LANDIS Tangential Chasers ensures threading economy. It is further important to know that these chasers, requiring only a few thousandths metal removal to restore the cutting edge, are usable for 80% of their original length. In addition, it is not necessary to remove the same amount of metal from all chasers of a set, or to replace the entire set at the same time.

LANDEX Hardened and Ground Heads are unmatched for precision threading and true economy on bar automatics and other live-spindle machines with limited clearance. Let us show you how to improve threading operations—send specifications and ask for Bulletin F-80.



The world's largest
manufacturer of
threading equipment

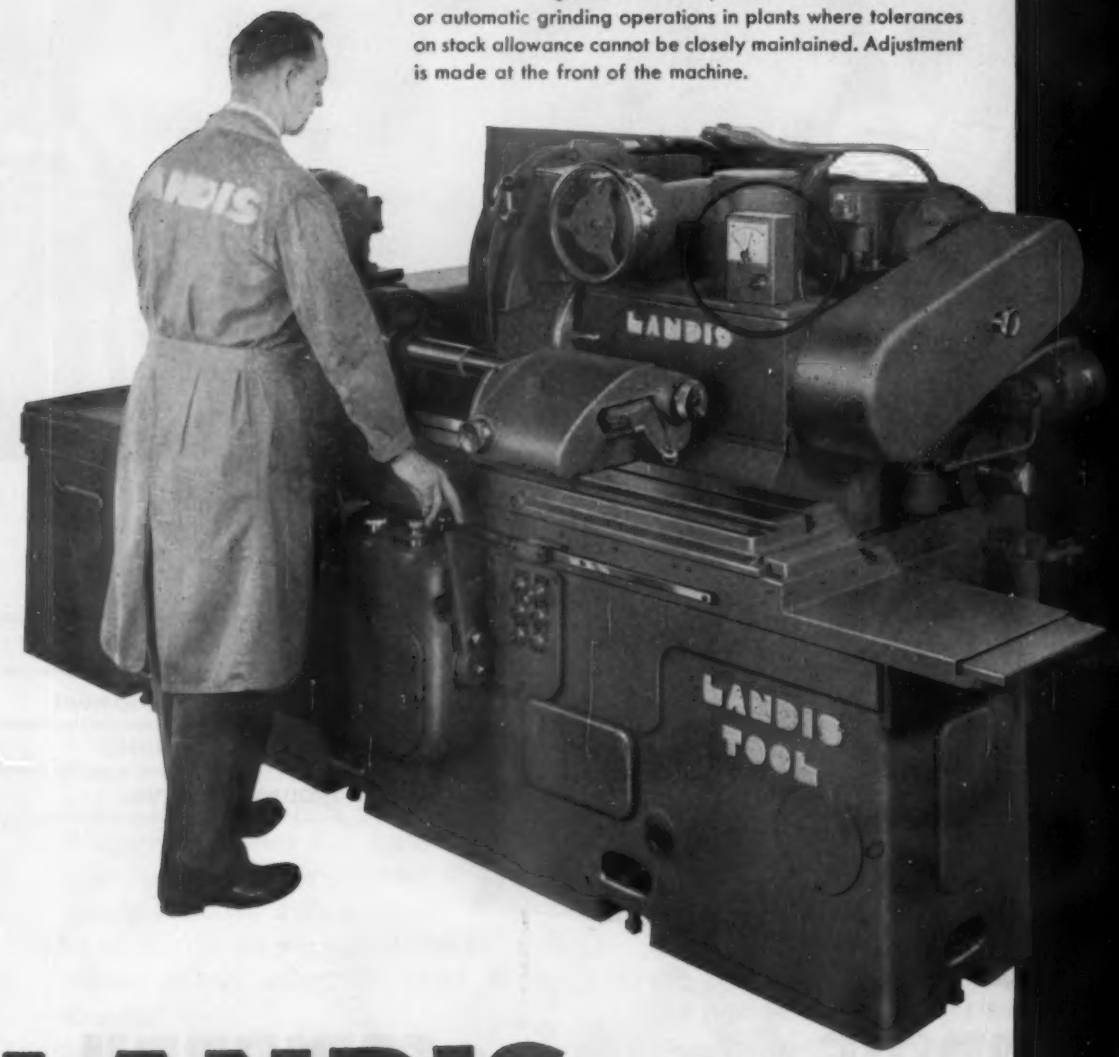
CUTTING • GRINDING
ROLLING • TAPPING

LANDIS *Machine* COMPANY

502C WAYNESBORO • PENNSYLVANIA • U.S.A.

New Landis automatic Wheel Approach Control saves valuable production time

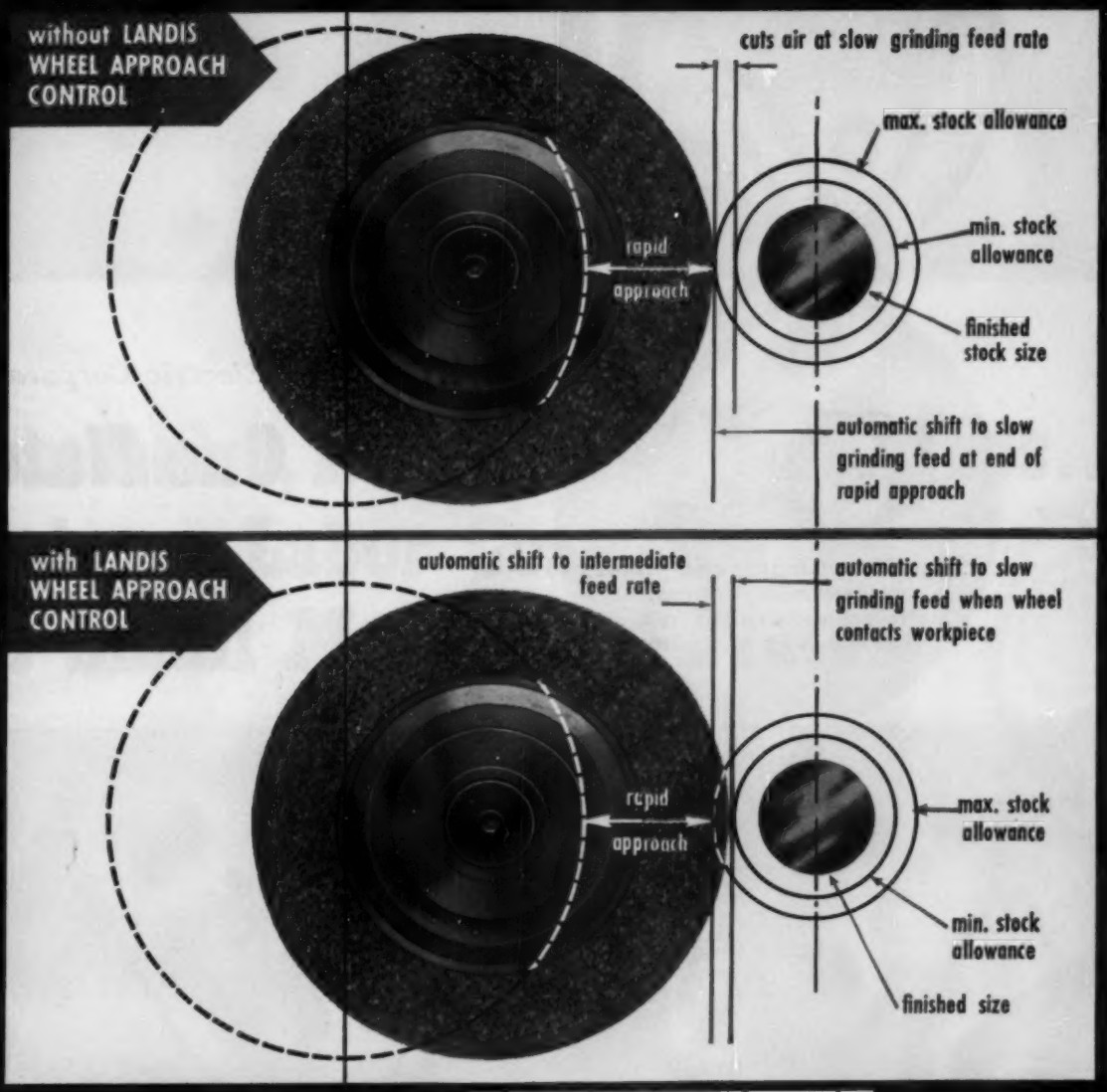
Landis automatic Wheel Approach Control is now available on new Landis grinders. It cuts cycle time on semi-automatic or automatic grinding operations in plants where tolerances on stock allowance cannot be closely maintained. Adjustment is made at the front of the machine.



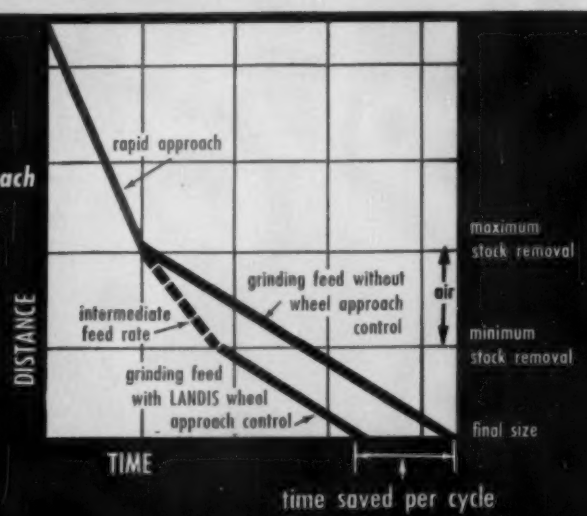
LANDIS
precision grinders

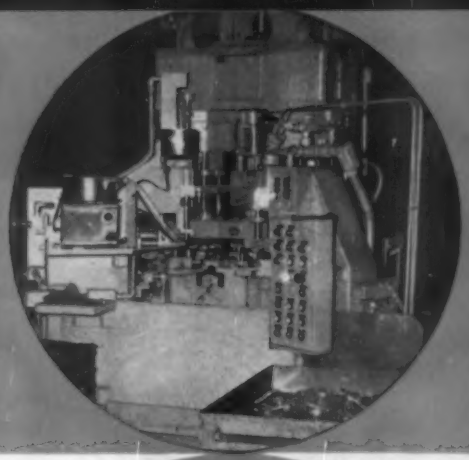
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

this is how LANDIS WHEEL APPROACH CONTROL works


without LANDIS WHEEL APPROACH CONTROL
cuts air at slow grinding feed rate
max. stock allowance
min. stock allowance
rapid approach
finished stock size
automatic shift to slow grinding feed at end of rapid approach
with LANDIS WHEEL APPROACH CONTROL
automatic shift to intermediate feed rate
automatic shift to slow grinding feed when wheel contacts workpiece
rapid approach
max. stock allowance
min. stock allowance
finished size

how LANDIS automatic wheel approach control saves production cycle time





Two sizes of motor end-plates are assembled, bored, drilled and tapped in a Natco 3-Way Machine.

At Wagner Electric Corporation

One Natco

NATCO

Assembles, Bores, Drills and Taps... Reduces Labor Cost 70% On Small Motor End-Plates

This Natco combination assembly and multi-drilling machine presses a bearing sleeve into the end-plate, rough and finish bores the outside bearing-cap hole, drills an oiler hole at an angle, drills four (4) thru-bolt holes, and drills and taps two (2) 8x32 cover plate holes. *Production is 170 pieces per hour.*

This Natco accommodates two sizes of motor end-plates without changes in the basic rotary-table tooling. In addition to this important versatility the engineers at Wagner Electric point out these other advantages:

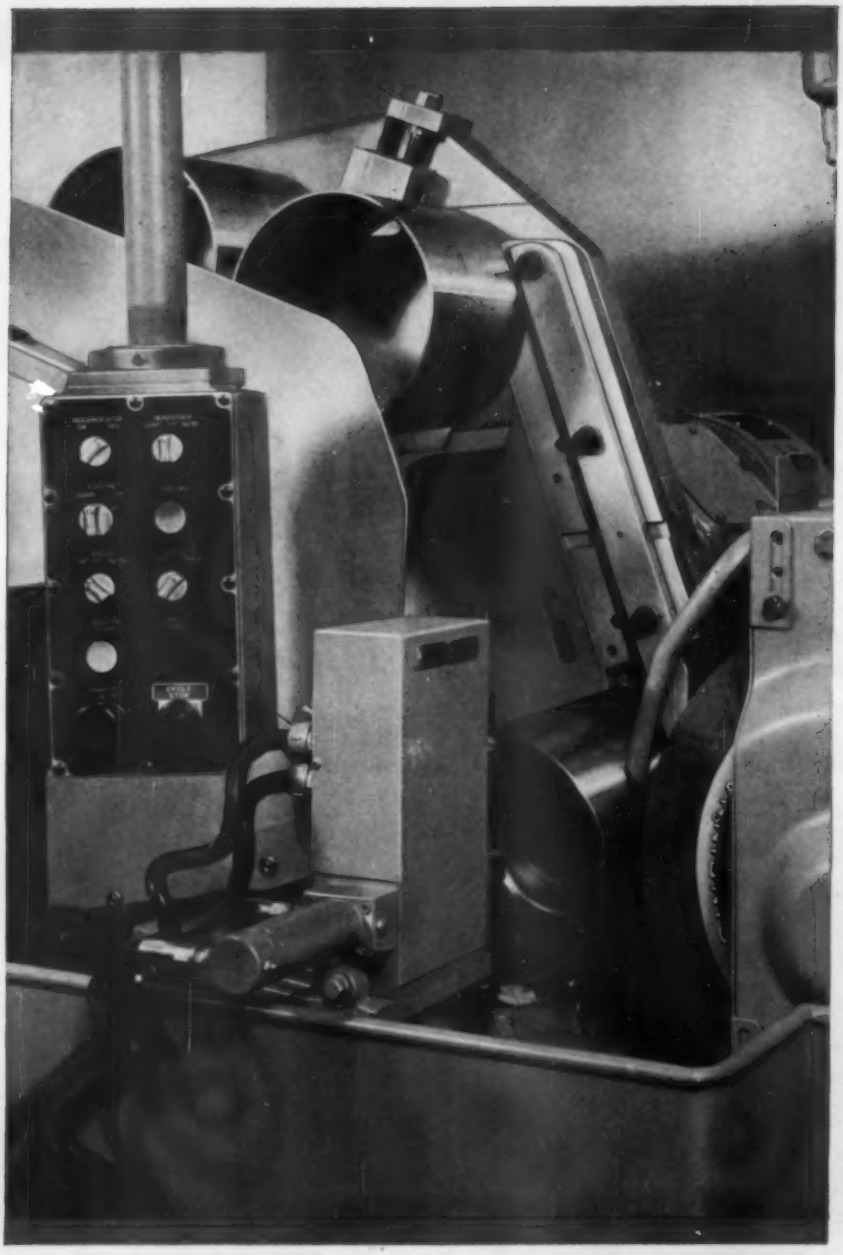
- *one operator* controls the assembly and machining from one station.
- *work scheduling* is simplified due to the short machine cycle.
- *in-process inventory* can be kept at a minimum because of high production rate.
- *floor space* is made available for other operations.

Natcos perform all kinds of drilling, boring, facing and tapping jobs in every conceivable combination and sequence.

Ask the Natco Field Engineer about the newly perfected tape control systems for Natco production tools.

National Automatic Tool Company, Inc.

Richmond, Indiana *Multi-spindle drilling, boring and tapping machines. Special machines for automatic production. Call Natco Offices in Chicago, Detroit, New York, Buffalo, Philadelphia, Cleveland, Los Angeles; distributors in other cities.*



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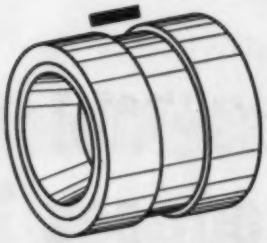


Drawing of part. Diameter ground is indicated by heavy line.

Part name . . . . anti-friction ring

Production . . . . 40 per hour for 10" rings

FILMATIC

Micro-Centric grinding applied to large parts up to 10" diameter. Loading and grinding are automatic for the operation of grinding a narrow section to perfect roundness.

CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Anti-Friction Bearing Rings

are ground perfectly round

on the Cincinnati Filmatic Micro-Centric

Perfect roundness is a tough specification for any high production grinding operation. And the larger the part, the more difficult the specification becomes for ordinary grinding methods. A prominent manufacturer of anti-friction bearings solved the problem by enlisting the aid of Cincinnati Grinding and Automation Specialists, and performing the job of grinding the center section of 10" diameter rings on a CINCINNATI® FILMATIC No. 2 Micro-Centric. ¶The machine is tooled up for automatic production, and includes several cost-reducing features such as automatic loading fixture, adjustable for 6" to 10" diameter range . . . automatic reciprocation for grinding wheel spindle with interlock for truing . . . automatic cross feed compensation to maintain constant length of cycle. ¶This equipment is typical of the fine grinding machines and modern tooling available at Cincinnati. Our specialists are ready to give you the benefit of their experience in six distinct types of precision grinding: centertype, centerless, chucking, Micro-Centric, centerless lapping, roll. Make Cincinnati your headquarters for fine standard and special precision grinding machines. It's to your advantage to do so.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

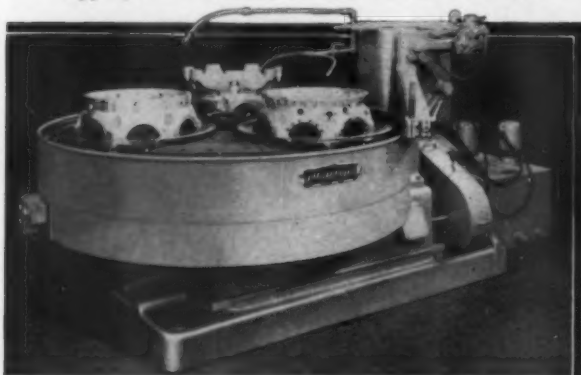
7 great lapping machines for your profit-boosting

If you are performing single or parallel face flat lapping operations you'll get real profit-boosting qualities from the ability of these machines to improve your product quality — shorten production time — lower your lapping costs. In other words — from their ability to give you the "Touch of Gold".

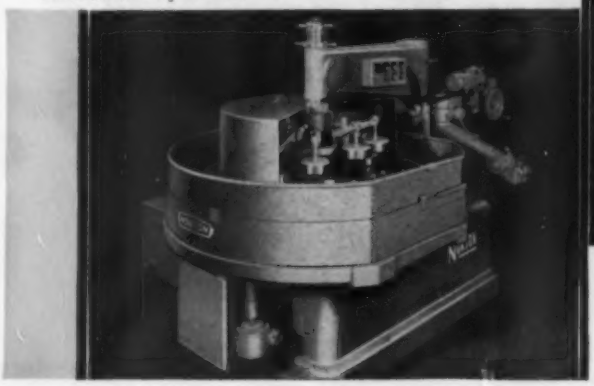
With NORTON HYPROLAP* machines you'll lap fast — and get clean work on which you can do further machining without cleaning operations — because their bonded abrasive laps leave your parts free of imbedded grit. The hydraulically operated truing devices on these machines provide additional advantages in assuring truth of lap face — plus the convenient means of quickly changing lapping action by rough or fine truing of the lap by simple adjustment of the speed of the truing arm.

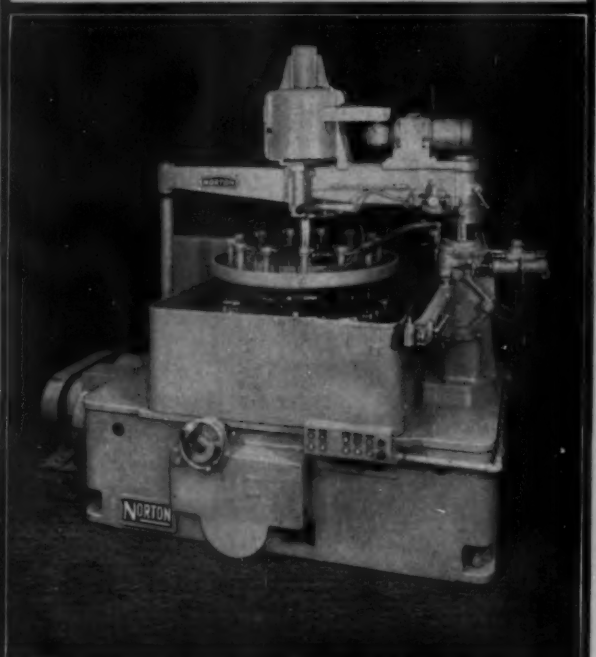
For operations requiring cast iron laps, you will get continuing high investment return — and steady, low cost production from the #16-FC and #28 Lapping Machines — because of their simplicity of operation — and outstanding durability. They'll operate steadily for you with minimum attention or maintenance — hour after hour — day after day.

For further facts see your Norton representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

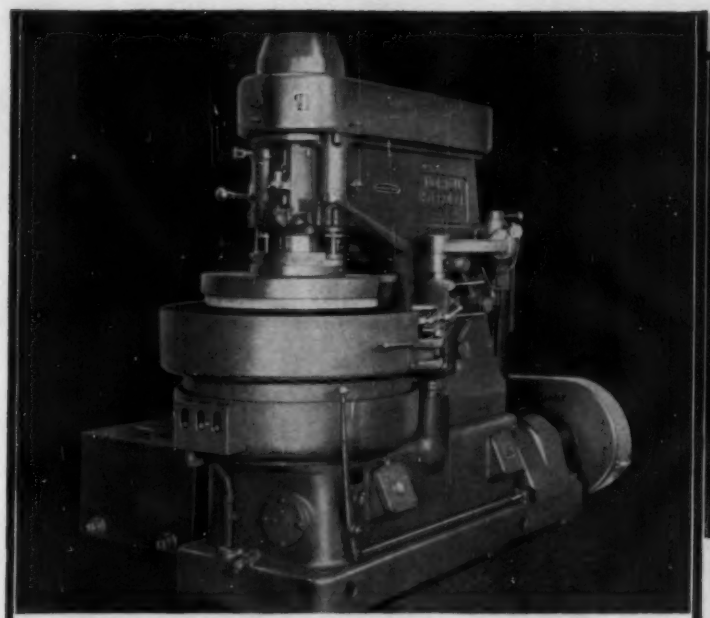


HYPROLAP SINGLE FACE FLAT LAPPING MACHINES #60-F (above) and #36-F (below). Sensational performers using bonded abrasive laps and filtered coolant. Provide clean seal surfaces, wear surfaces or reference surfaces for further machining. Available for small or large production lots: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Rigid power-operated truing arm insures true flatness of abrasive lap and finished work pieces. Heavy or light parts handled with equal ease.





HYPROLAP SINGLE OR PARALLEL FACE FLAT LAPPING MACHINE #48-F. Similar to the #60-F and #36-F Lappers in speed and accuracy, with provision for parallel face flat lapping. For single face flat lapping the machine mounts a single 48" diameter bonded abrasive lap. For lapping opposed parallel flat surfaces an upper lap is added. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed.

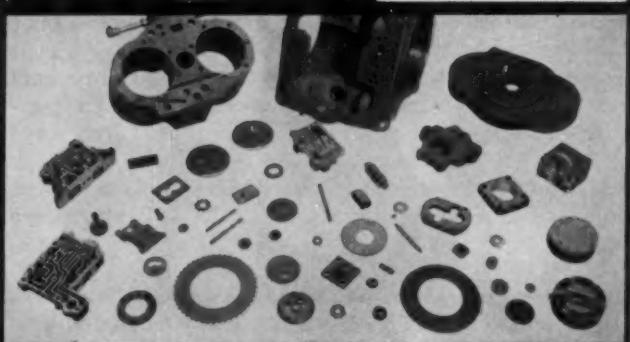


HYPROLAP LAPPING MACHINE #26. A high speed machine for two face flat lapping or cylindrical lapping that finishes up to 100 or more work pieces simultaneously. Lapping pressure is hydraulically powered and controlled — an exclusive Norton development. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Like other HYPROLAPS, lap truing is hydraulically powered and controlled.

HYPROLAP LAPPING MACHINE #12-F. For small, parallel face flat lapping. Ideal for small ball bearings. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. All three provide fast efficient lapping with selective speeds for laps and work-holders, permitting positive selection of ideal speeds for each job. Cleanliness of finished work surfaces eliminates the need for cleaning operations.

PLAIN TIMED CYCLE LAPPING MACHINE #28. Produces flat or cylindrical surfaces to extremely close tolerances and high degree of finish. Uses cast iron laps with loose abrasive. An attachment for cylindrical lapping is furnished with the regular flat lapping arrangement. For plug gage or gage block tolerances the machine is unsurpassed. An arrangement for hand lapping with 30", 36" or 40" cast iron laps is also available.

PLAIN TIMED CYCLE LAPPING MACHINE #16-FC. An outstanding performer for flat or cylindrical work, such as Diesel injector parts, plug gages, size blocks, sides of rings and short cylindrical parts. Using cast iron laps with loose abrasive it produces optically flat surfaces to extremely close thickness tolerances. Its fine repetitive accuracy helps reduce inspections and eliminates the need for selective assembly.



NORTON JOB LAPPING SERVICE. Improve your product quality by precision lapping. The Norton Job Lapping Department, complete and modern in every detail, is ready to finish jobs to your exact specifications. Flat or cylindrical lapping operations handled quickly to your tolerance specifications. Parallel face flat lapping is our specialty. See your Norton representative or write direct.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

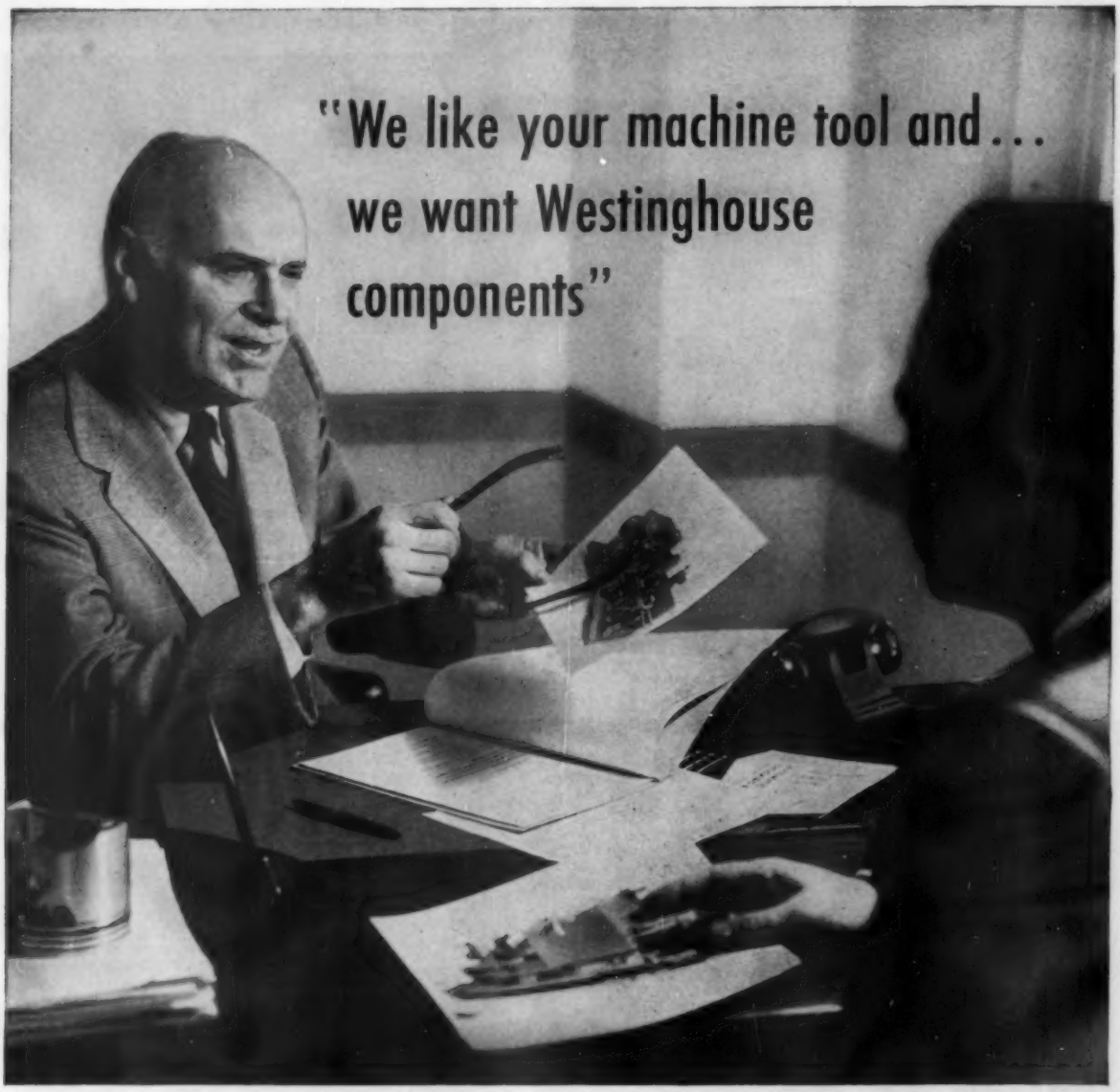
Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cut Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



A sound decision . . . because getting the most for your machine-tool dollar requires dependable components.

That's why it's good practice to always specify Westinghouse components for your machine tools. They're the result of extensive engineering experience and continuing research aimed at developing units that best serve your equipment.

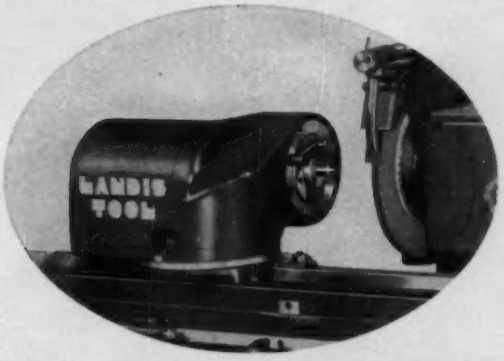
Westinghouse machine-tool experience in the design, application and servicing of components covers four decades. When you choose Westinghouse . . . you can be *sure*. J-06105

Specify these Westinghouse components when you buy machine tools:
Motors • Controls • Pushbuttons • Gearmotors • Speed Reducers • Adjustable-Speed Drives • Semiconductors • Cypak* Static Control • Rectifiers • Magamp* Magnetic Amplifiers • Instruments • Relays • Machine-Tool Transformers • DYNAC® Magnetic Braking.

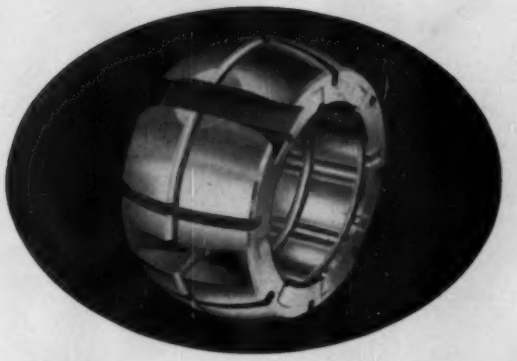
*Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse

Low cost general purpose grinder with 2 exclusive "big grinder" features...



Variable speed headstock... compact design with only two revolving parts. Can be swiveled for angle or face grinding.

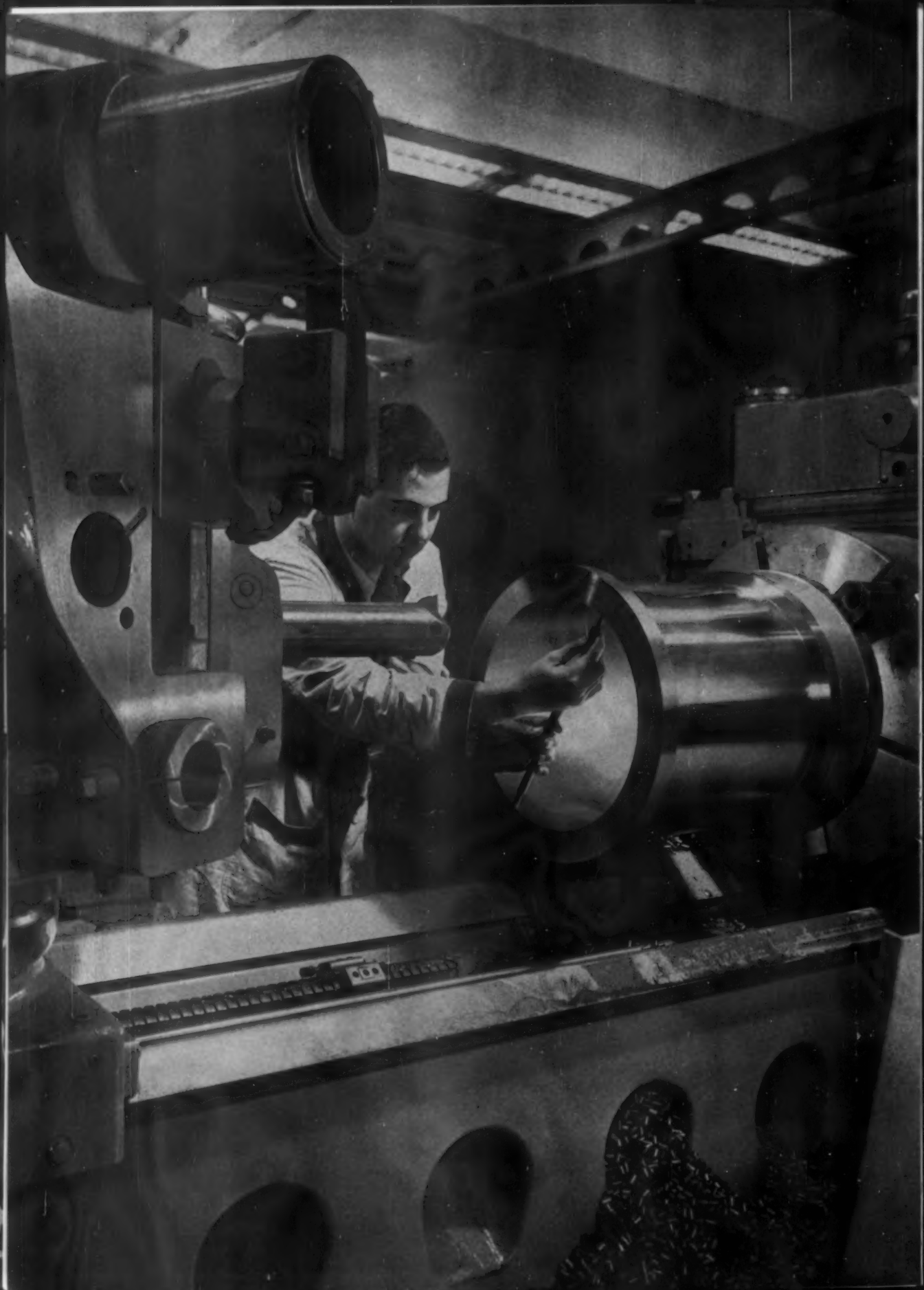


Microsphere bearings... close running clearance of Landis Microsphere spindle bearings gives faster spark-out, accurate, quick response to wheel feed.

LANDIS 12" x 28" Grindwell Universal ... compact, precision grinder for manufacturing, maintenance, toolroom and training.

LANDIS
precision grinders
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

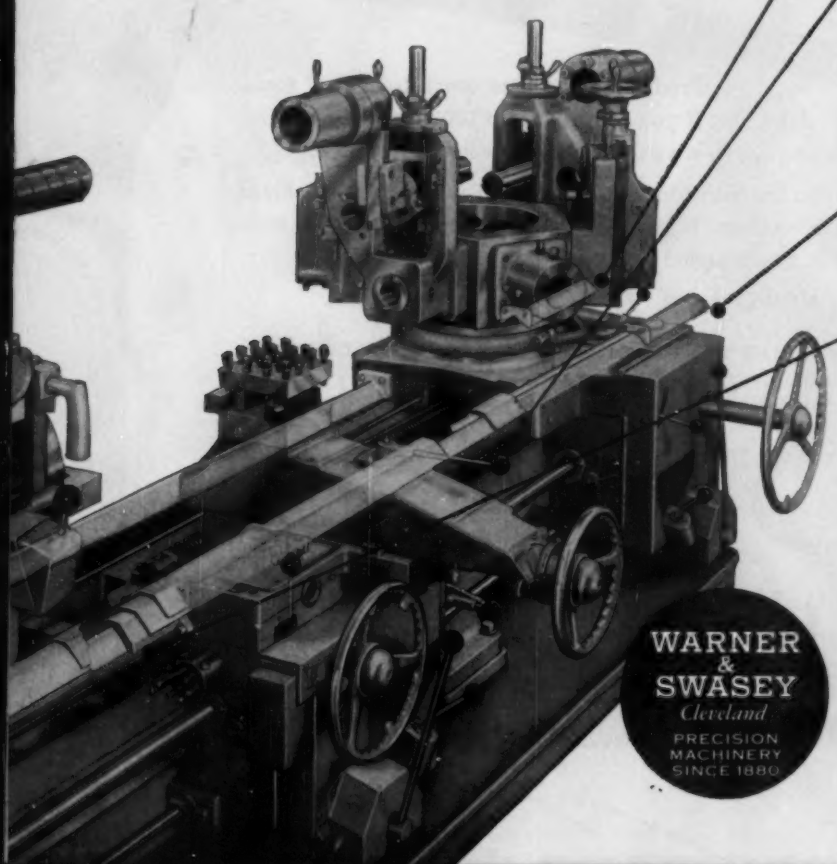
ERGONOMICS



covered **VEE-WAYS**

preserve Warner & Swasey's original accuracy and ease of operation

Tools, gritty materials and cutting fluids can fall on the covers — but Warner & Swasey's exclusive covered ways maintain their accuracy and free-sliding smoothness throughout years of hard use with a minimum of maintenance. As a result, dependable, close-tolerance performance is easy to maintain without fighting or pampering the machine. With Warner & Swasey Saddle Type Turret Lathes, operators stand closer and more comfortably to their work. That's because strength and rigidity of the bedways are achieved through cross-rib supported "Vee" ways instead of by mere mass and width of the bed. They report their Warner & Swaseys are easier to handle because all movable units slide on well-lubricated bearing surfaces enclosed and protected by patented telescoping way covers. Harmful chips and grit are kept out — coolant cannot wash away the film of lubricant from way surfaces. When operators like the equipment on which they work — production increases. Why not let our Field Representative show you all the operator advantages designed into Warner & Swasey turret lathes? It can save you money.



These patented way covers protect from accidental dropping of heavy objects. Chips cannot work between the ways and carriage or saddle units to damage important bearing surfaces. Also, lubricant is not washed away by flooding coolant or combined with dust and oil to gum up bearing surfaces.

Warner & Swasey's exclusive one-piece head and bed casting gives increased strength without increased weight. Its diagonal-rib bracing assures greater rigidity and accuracy. Vee-ways are induction-hardened and precision-ground to give greatest wear resistance and a long, accurate life.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

"Competitors wonder how I'm cutting production costs . . . the answer is

MORSE Electrolized* TOOLS"

Production costs are tough to control nowadays. But if you can get up to 100% more production out of the cutting tools you use . . . then you've got a real competitive edge.

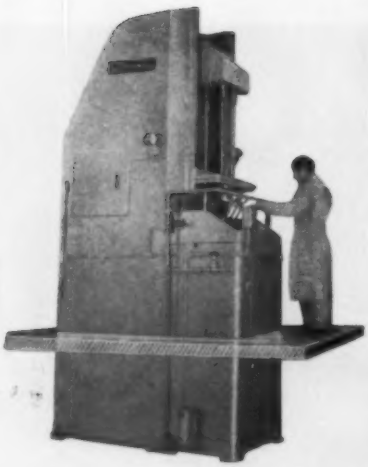
That's exactly what you can do, with Morse Electrolized Tools on your machines. Not only do you get more production, but you get it cleaner and faster with more closely held tolerances over a longer period of time.

Another reason why . . . MORSE means "THE MOST" in cutting tools.

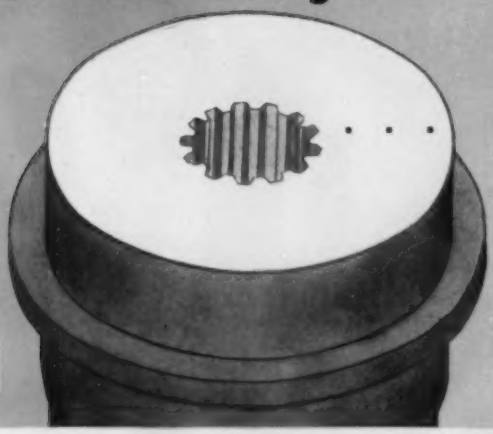
MORSE TWIST DRILL & MACHINE COMPANY, NEW BEDFORD, MASSACHUSETTS

A Division of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE
Cutting Tools



To slash your time



Some jobs, like the involute spline shown here, are a "natural" for broaching. Most production men would automatically decide on broaching to machine this part. But what about some other parts you may be producing, with repetitive forms? It's a good bet that many of them could be Lapointe-Broached, at a substantial saving to you.

One big step you can take to insure future profits is to critically examine the production processes in your plant. Are you milling when you should be broaching? Are you using a drill, planer, or shaper when Lapointe-Broaching could do the job *more accurately, with no scrap . . . also faster and cheaper?*

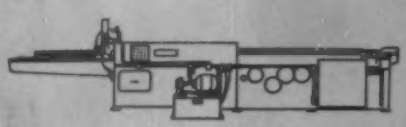
It costs you nothing to ask, and we believe you will be impressed with what a qualified Lapointe Field Engineer can tell you about money-saving opportunities in your plant . . . through conversion to Lapointe-Broaching. Remember: Lapointe can take full responsibility for the success of an entire broaching program. We design and build the broaching machines, the broaching fixtures, and the broaches.

THE LAPOINTE MACHINE TOOL COMPANY

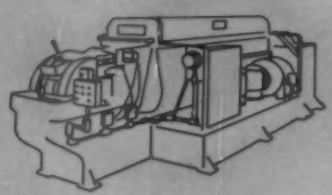
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

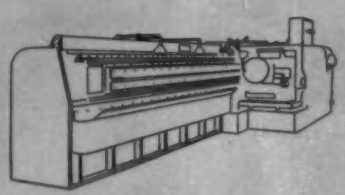
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

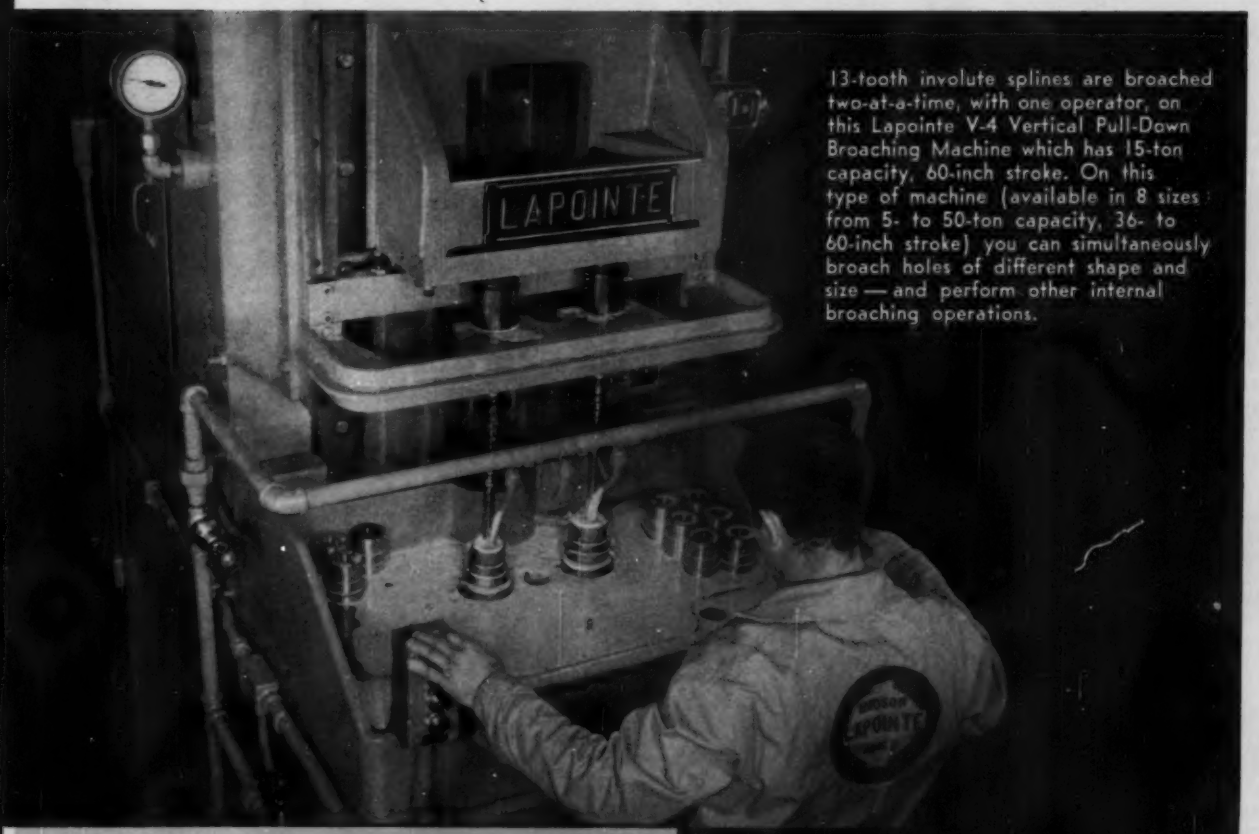


SRHE SINGLE RAM HORIZONTAL, ELECTRIC

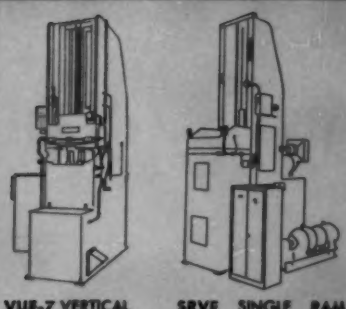
and production costs,

. . involute splines and many other types of holes (whether round or irregular)

should be LAPOINTE -BROACHED

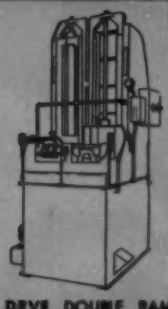


13-tooth involute splines are broached two-at-a-time, with one operator, on this Lapointe V-4 Vertical Pull-Down Broaching Machine which has 15-ton capacity, 60-inch stroke. On this type of machine (available in 8 sizes from 5- to 50-ton capacity, 36- to 60-inch stroke) you can simultaneously broach holes of different shape and size — and perform other internal broaching operations.



VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC



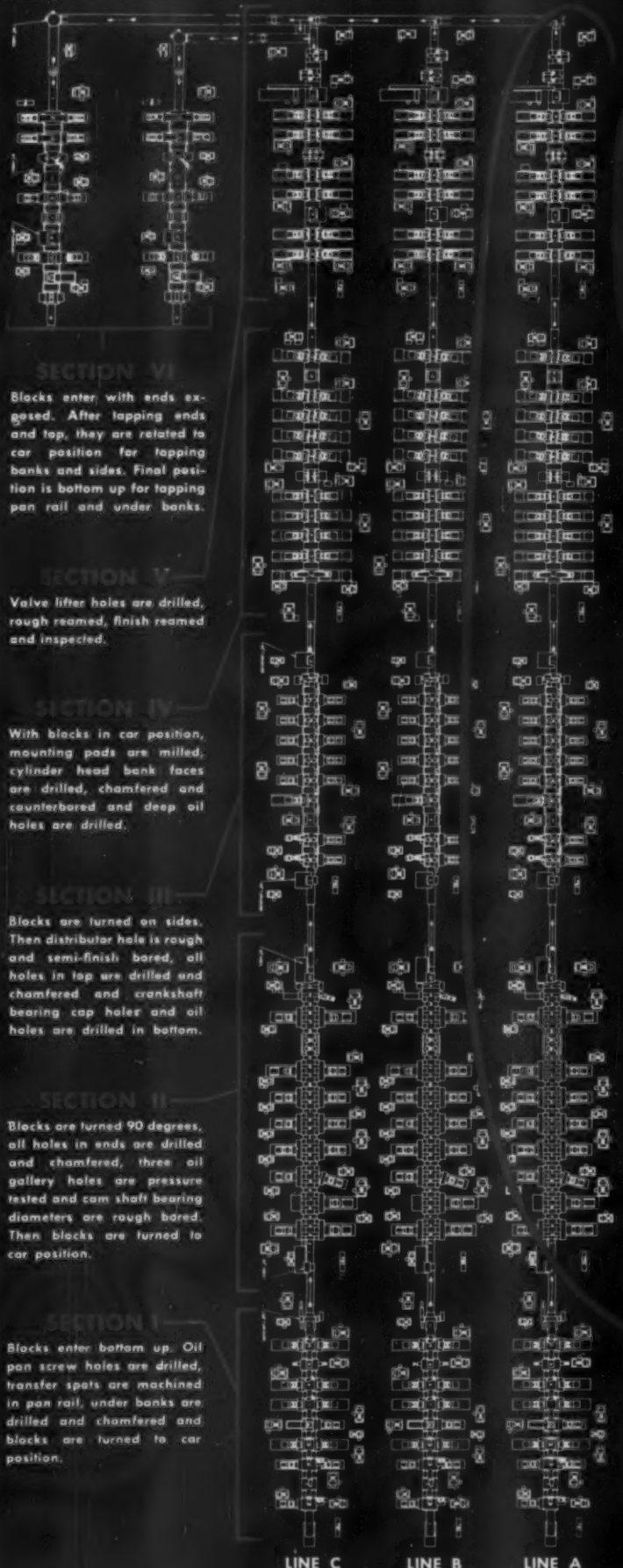
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

1300 ft. Transfer-matic Performs 2291 Operations on V-8 Blocks



SECTION VI

Blocks enter with ends exposed. After tapping ends and top, they are rotated to car position for tapping banks and sides. Final position is bottom up for tapping pan rail and under banks.

SECTION V

Valve lifter holes are drilled, rough reamed, finish reamed and inspected.

SECTION IV

With blocks in car position, mounting pads are milled, cylinder head bank faces are drilled, chamfered and counterbored and deep oil holes are drilled.

SECTION III

Blocks are turned on sides. Then distributor hole is rough and semi-finish bored, all holes in top are drilled and chamfered and crankshaft bearing cap holes and oil holes are drilled in bottom.

SECTION II

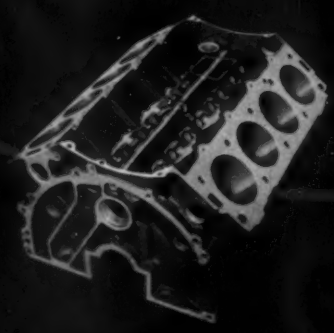
Blocks are turned 90 degrees, all holes in ends are drilled and chamfered, three oil gallery holes are pressure tested and cam shaft bearing diameters are rough bored. Then blocks are turned to car position.

SECTION I

Blocks enter bottom up. Oil pan screw holes are drilled, transfer spots are machined in pan rail, under banks are drilled and chamfered and blocks are turned to car position.

Here is the answer to the automobile industry's insistent request for machine tools which will reduce the cost of model changes and shorten change-over periods. This giant "Sectionized" Transfer-matic is constructed with an entirely new set of Cross building blocks and applies new concepts of standardization to machine bases, transfers, fixtures and heads.

- ★ Capacity to machine any passenger car engine block.
- ★ 270 stations in 17 sections, each with independent controls; sections operate automatically as blocks are made available; any section may be stopped without interrupting production of others.
- ★ 2291 operations on 185 blocks simultaneously.
- ★ Rated capacity of 350 cylinder blocks per hour.
- ★ Cross Machine Control Units with Toolometers for efficient tool programming.
- ★ Pre-set tools to reduce downtime.



Another Automation First by Cross

Photo shows Sections II, III, IV and V of Line A.

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

LINE C LINE B LINE A

ALL NEW

- Exclusive HERRINGBONE drive—the only radial built with this advanced feature.
- Pre-loaded, four-bearing spindle and chromium plated sleeve.
- Hydraulic arm and column clamping, special separate motors and complicated electrical controls are ELIMINATED!
- A positive lock-out of the power feed is available. When plunger is operated, it guards against accidental engagement of power feed during tapping or reaming.
- Head-moving handwheel is DE-CLUTCHED when head is traversed by power. Possible operator injury is completely eliminated.
- Two sealed-beam work lights, one on each side of spindle, never get hot . . . impervious to damage from chips and coolant.
- 36 speeds up to 2300 rpm, 18 feeds including 8 geared tap leads.

PARK GROVE STATION • DETROIT 5, MICHIGAN

CINCINNATI BICKFORD
Super Service Radials

MODERN DESIGN and latest engineering developments built in the ALL-NEW Super Service Radial drilling machines give you *higher production . . . faster, safer operation . . . and greater machining accuracy.* Here are a few of the reasons why:

Exclusive de-clutchable HERRINGBONE DRIVING GEAR provides the necessary power to drive large diameter drills and heavy cutting tools for maximum penetration. When higher speeds are used, such as for small taps, the herringbone driving gear is de-clutched, eliminating excessive velocity.

Three head designs available—*lever shift control* of all 36 speeds and 18 power feeds; *complete hydraulic pre-selection* of speeds and feeds; *hydraulic pre-selection of speeds only*—manual control of power feeds.

A positive safety device is provided in the head traverse mechanism to guard against damage should the head strike the workpiece or other objects during traverse. This safety functions *at any point* of head travel on arm. Head-moving HANDWHEEL DOES NOT REVOLVE when head is being traversed by power.

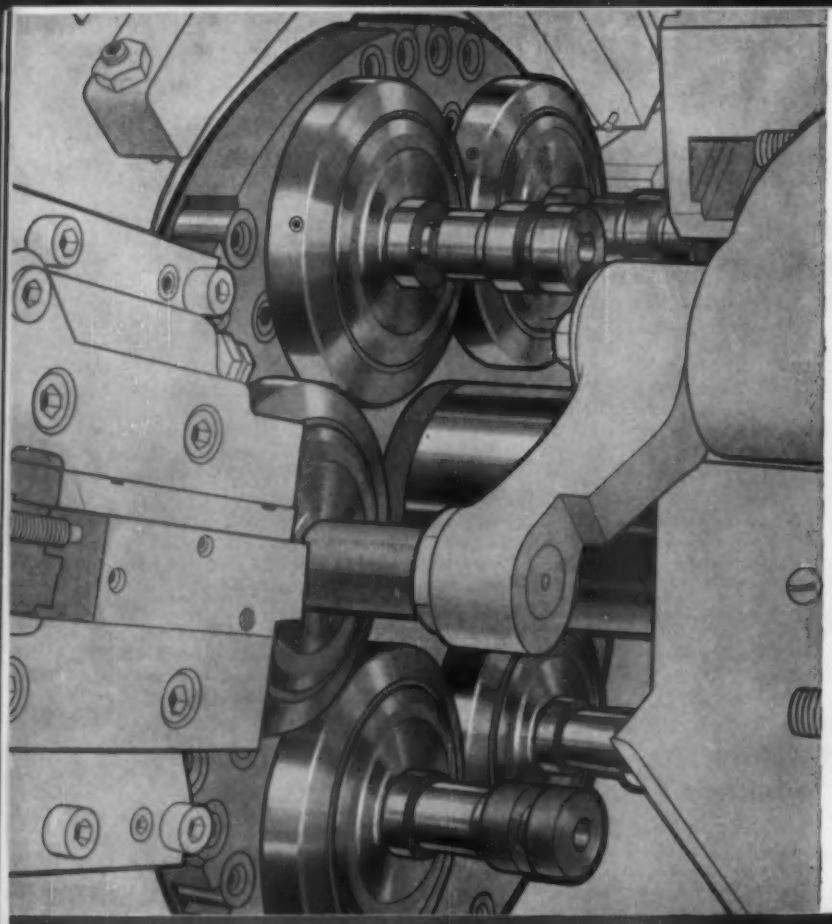
A pre-loaded, four-bearing, chrome nickel spindle and chromium plated sleeve . . . supported in a *honed head bore* over 17" long . . . assure maximum spindle rigidity, *regardless of position.*

The ALL-NEW Super Service Radials are available with 13", 15", 17" and 19" dia. columns, and 4, 5, 6, 7 and 8-ft. arms. For complete specifications on these powerful radial drilling machines, see your nearest Cincinnati Bickford sales representative.

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Upright Gang Drilling Machines, and Precision Production Drilling Machines designed for use with spacing table.

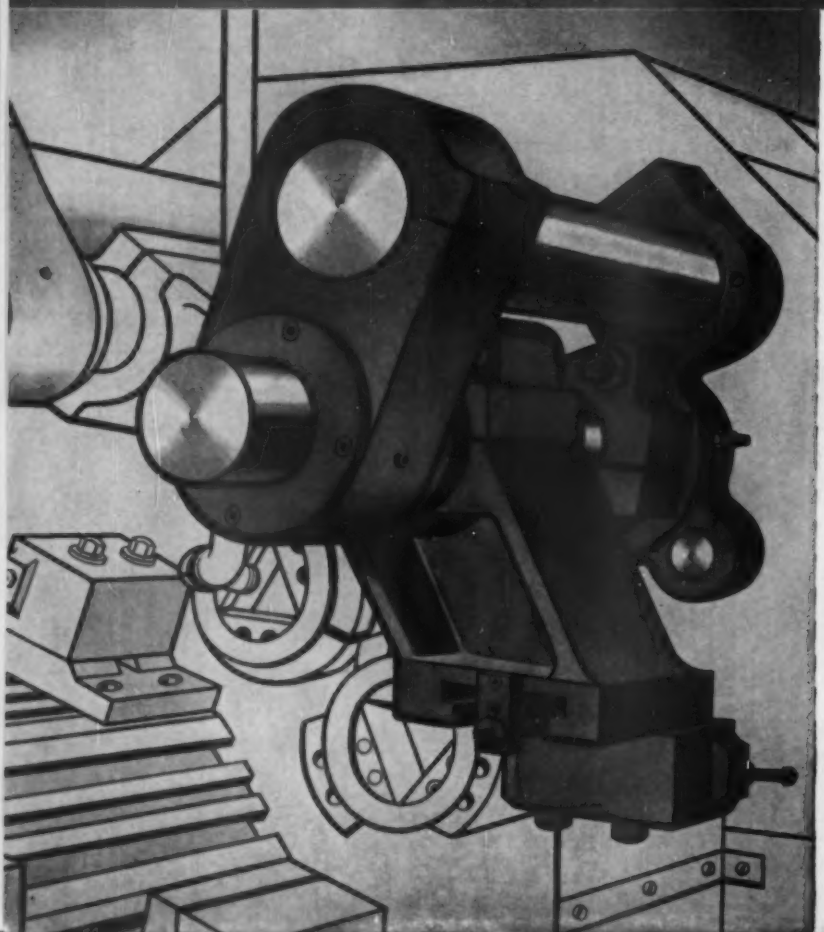
For complete specifications concerning Super Service Radials, ask for Bulletin No. R-35.



Look at New Britain's

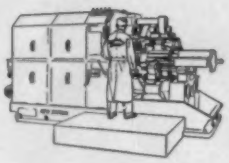
new automatic bar machines

The widest range of spindle speeds among machines of comparable capacity and accuracy.



Look at New Britain's

exclusive chucker arms

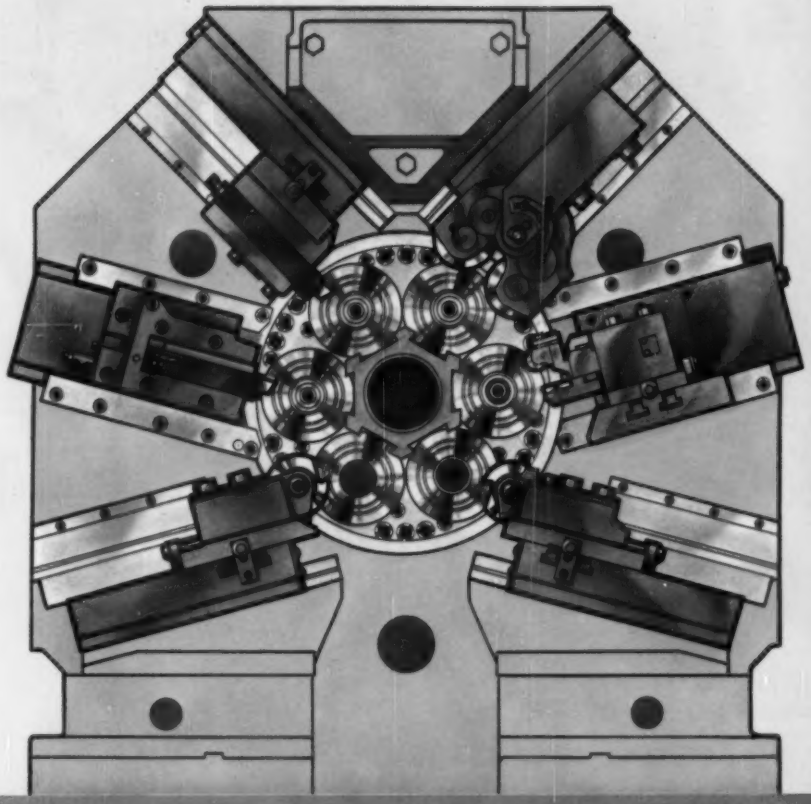


All the ruggedness of a cross slide, but with two-way motion for cutting O.D.'s, I.D.'s, tapers and radii and for recess boring, in addition to facing cuts. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

Look at New Britain's

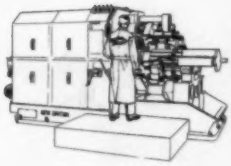
new cross slide arrangement

Independent radial cross slides in *all* positions, providing maximum clearance for more cross slide operations.

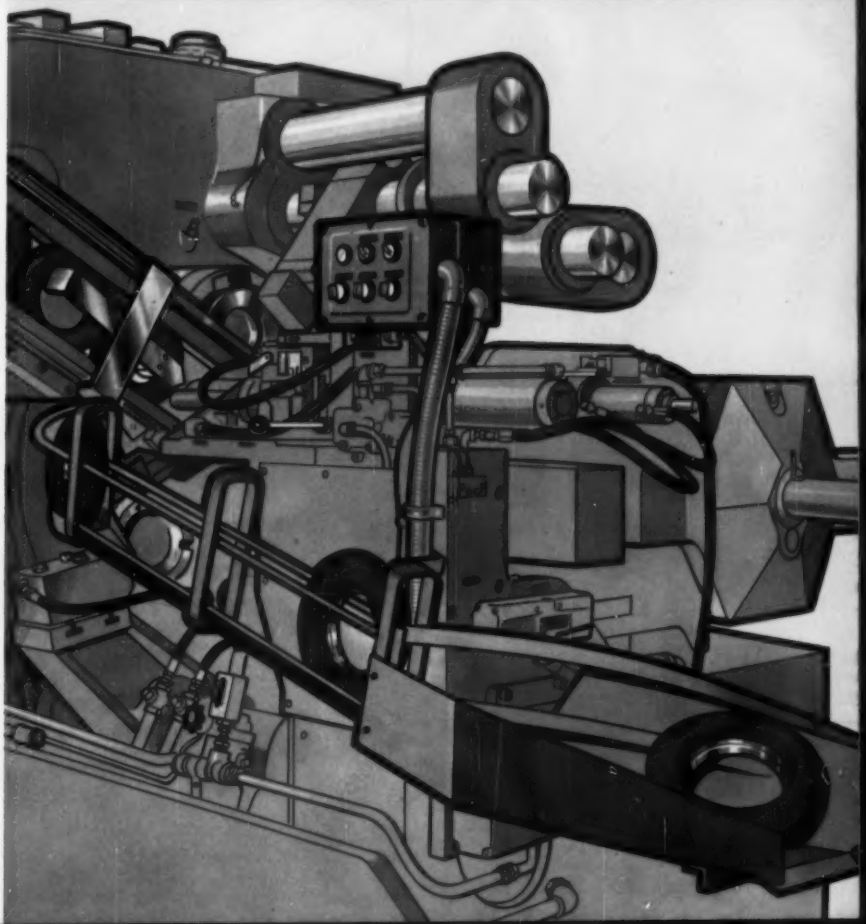


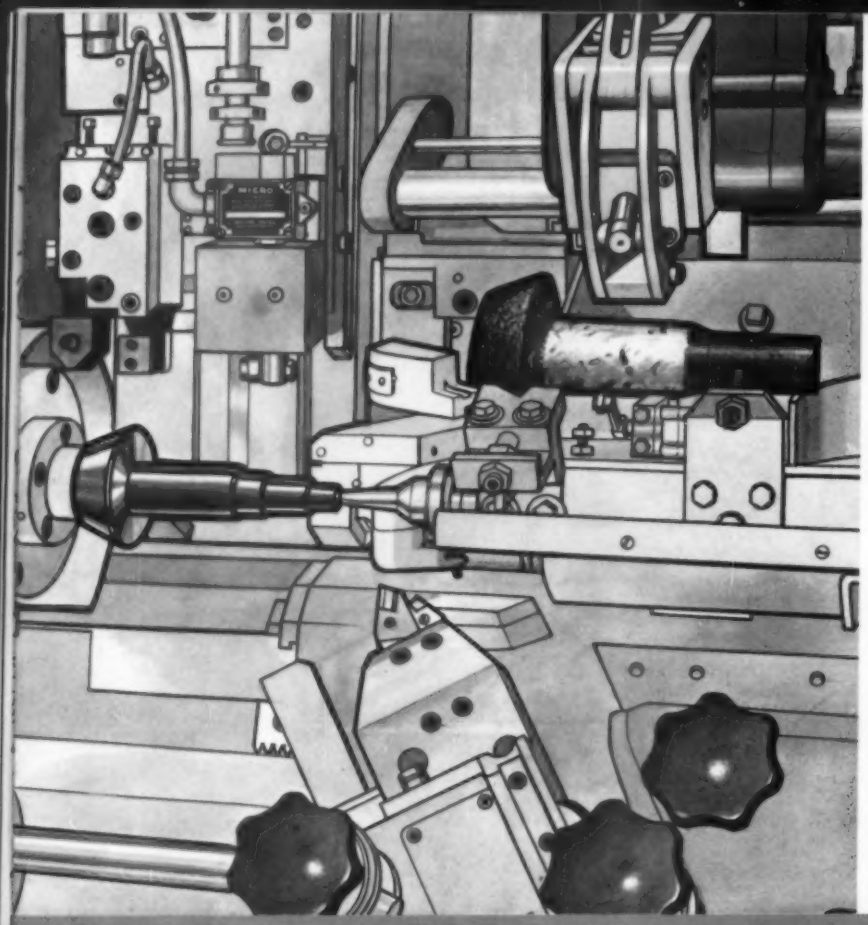
Look at New Britain's

open-end chucker design

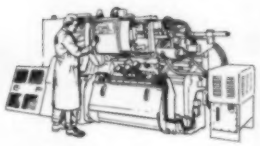


Greater accessibility for all applications and particularly well adapted to automatic handling of pieces. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

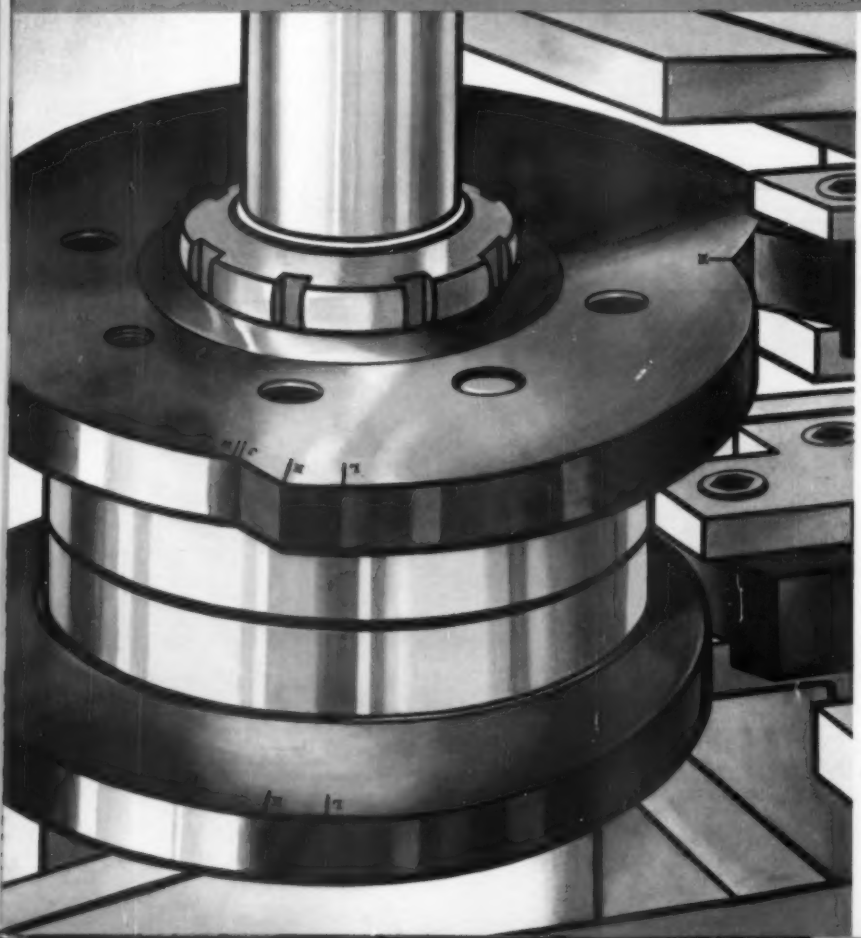




Look at
Automatic Loading on
New Britain +GF+



This basic optional feature can make money for you whether you are working with forgings, bar slugs, or bar stock.

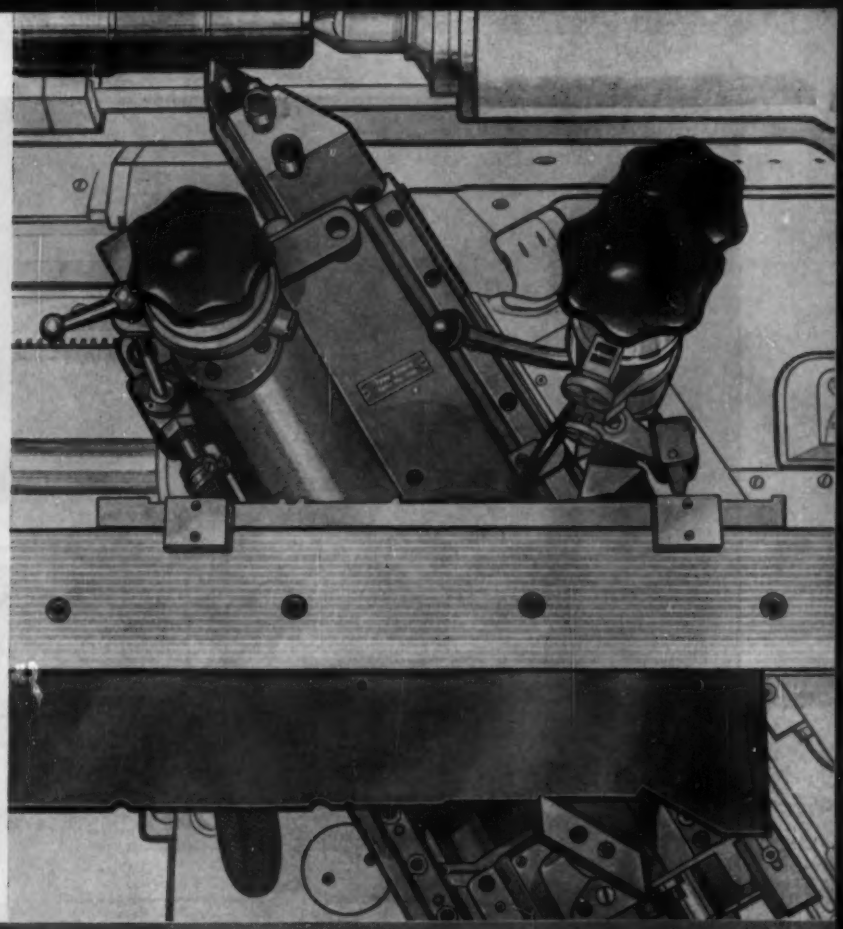


Look at New Britain's
cam-controlled boring machine

When you are working to tenths there is no substitute for the positive tool control that only precision cams provide. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

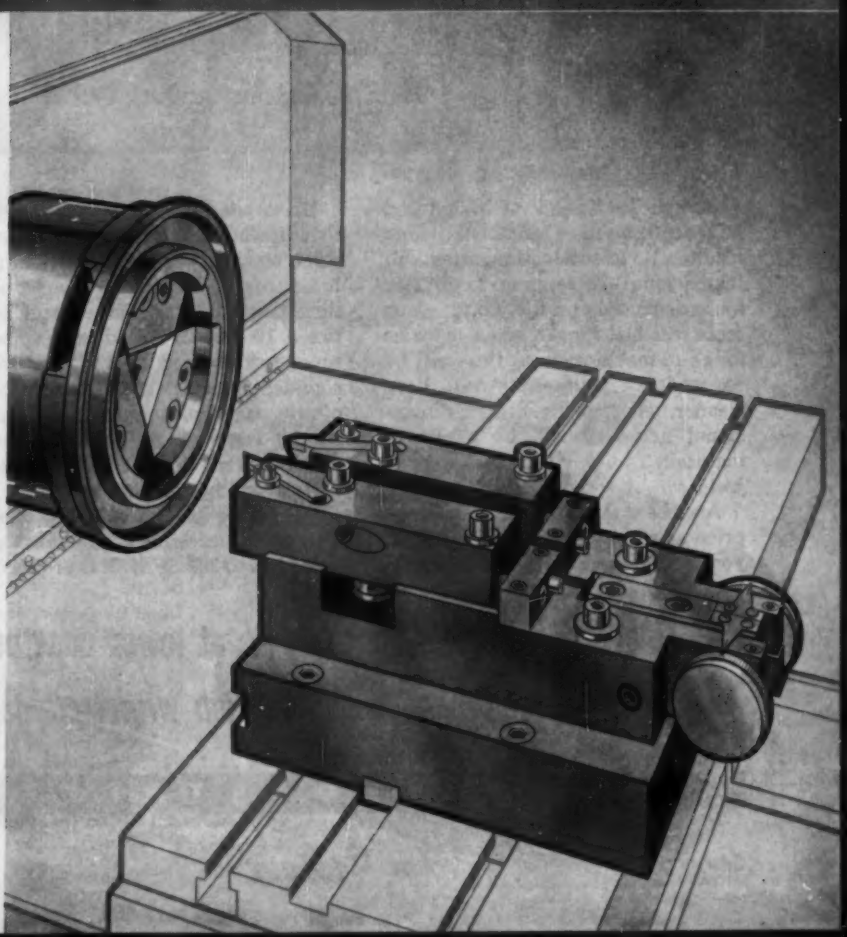
Look at
Single Point Tooling on
New Britain +GF+

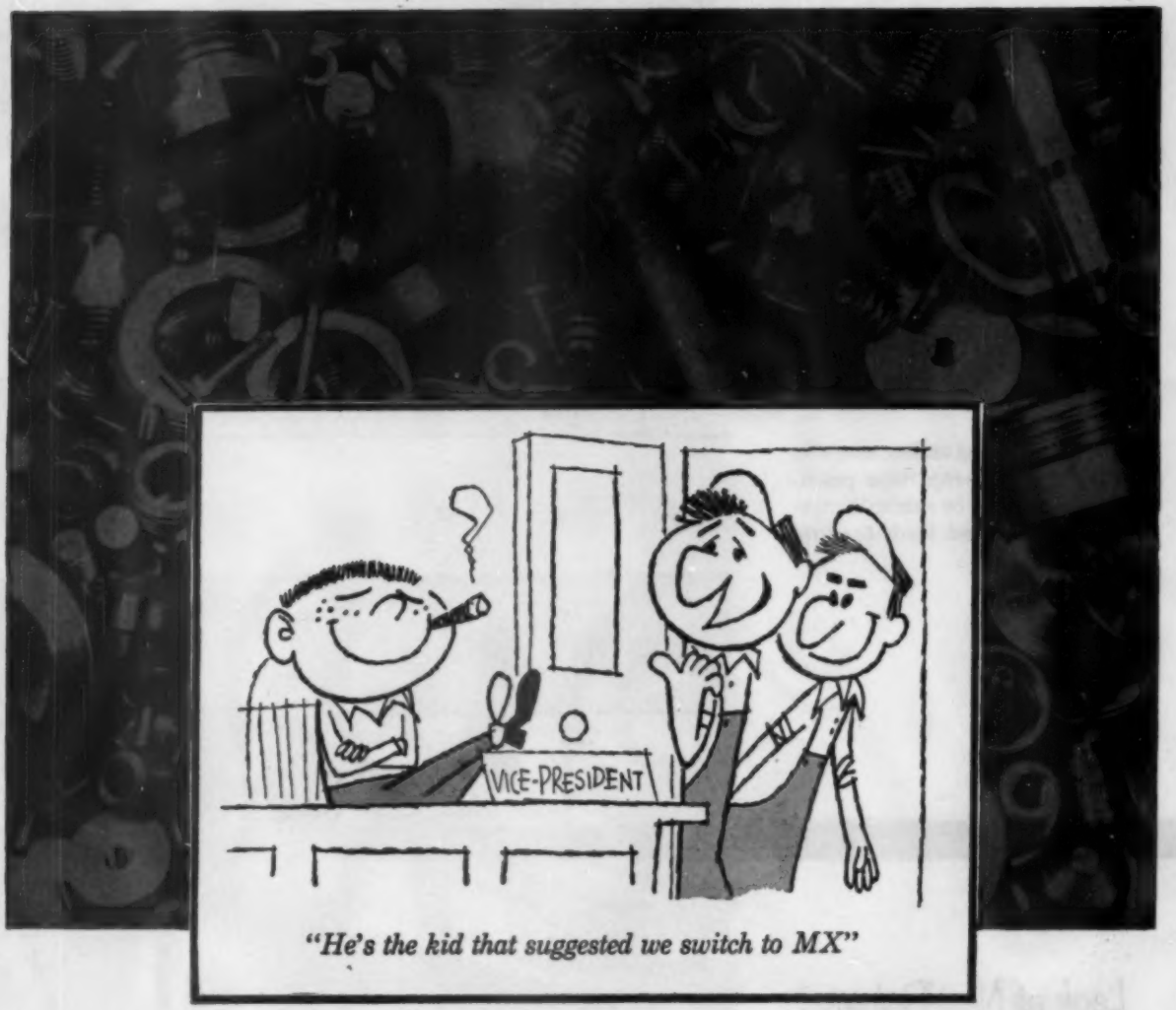
Outproduces gang tooling setups by reducing tool change time practically to zero, and by cutting at maximum speeds and feeds for tool efficiency.



Look at New Britain's
simple approach to problem pieces

Low cost per piece is inherent in New Britain Precision Boring Machines because of their simplicity, versatility, speed, repetitive accuracy and inexpensive tooling. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.





"He's the kid that suggested we switch to MX"

A switch to USS Free-Machining MX Steel can have some remarkable results. Your production rates will take a jump—increase up to 50% or more depending on the job . . . your tools will last longer, often twice as long . . . machine down time will be reduced . . . your parts will have cleaner, sharper finish . . . dimensional accuracy will be easier to maintain . . . you'll have fewer rejects.

And, because MX sells at the same price as regular screw stock grades, your production costs will be lower.

Hundreds of progressive shops that have put this faster-cutting screw stock to work have proved this to be true. Based on the cost reductions they report, which average between 10 and 15% and have sometimes run as high as 42%, we feel confident that MX will cut the cost of any part you now machine from regular screw stock. The more machine work required, the greater your savings will be.

USS Free-Machining MX Steel has been successfully machined at speeds up to 350 SFM. It is produced in all the popular screw stock sizes and is available in both Bessemer and Open Hearth grades. You can buy it in cold-finished form from your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest sales office. Why not give it a try?

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

More parts... better parts... at lower cost per part

USS

—when you do the job with free-machining

MX

UNITED STATES STEEL

hoover locks lube in, dirt out for the lifetime of the bearing

Hoover is first to seal ball bearings with TEFLON! Hoover makes *sure* that lube stays in, dirt stays away from the smooth, mirror-like working surfaces of high quality *Micro-Velvet* Lapped Balls and *Hoover Honed* Raceways. You get greatly extended bearing life.

Why TEFLON for seals? TEFLON is the remarkable new product of chemistry . . . extra tough . . . extra long wearing . . . and so slippery that there is practically no torque resistance. Hoover seals are ingeniously engineered to maintain positive contact and improve lube circulation. Permanently attached full metal shields lock the seals within the bearing, safe from damage.

Use Hoover Ball Bearings with single or double seals of TEFLON for high speed applications, electric motors, or wherever periodic lubrication or maintenance is not practical, as in sealed units. They are available in both light and medium series.

*TEFLON is DuPont's Trademark for its Fluorocarbon Resins.
Micro-Velvet and *Hoover Honed* are Hoover Trademarks.

hoover
BALL AND BEARING COMPANY
ANN ARBOR, MICHIGAN
SALES OFFICE AND WAREHOUSE: 2020 SOUTH FIGUEROA, LOS ANGELES 7, CALIFORNIA

OTHER HOOVER QUALITY BALL BEARINGS:
(light, medium, heavy series)

- Single and Double Shield
- Single Row Radial
- Combination Felt Seal and Shield
- Double Row
- Cartridge

NEW! BULLETIN 100—gives complete information on Hoover Bearings with Seals of TEFLON. To get your copy, just return the coupon below.

Hoover Ball and Bearing Company
Ann Arbor, Michigan

Please mail my copy of Bulletin No. 100 on Hoover Bearings with Seals of TEFLON.

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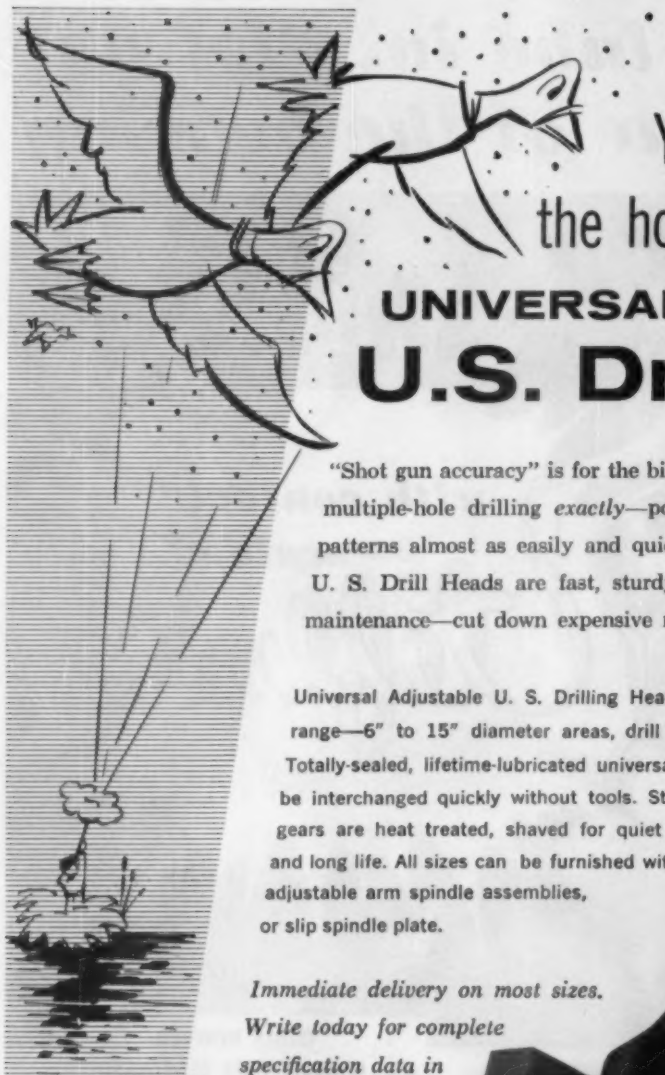


You **KNOW** where the holes will be . . . with

UNIVERSAL ADJUSTABLE

U.S. Drill Heads

"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling *exactly*—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints. U. S. Drill Heads are fast, sturdy, long-lived and require only minimum maintenance—cut down expensive re-operating cost, too!

Universal Adjustable U. S. Drilling Heads cover a wide range—6" to 15" diameter areas, drill sizes up to 1-1/16" Totally-sealed, lifetime-lubricated universal joints can be interchanged quickly without tools. Stub tooth gears are heat treated, shaved for quiet operation and long life. All sizes can be furnished with adjustable arm spindle assemblies, or slip spindle plate.

Immediate delivery on most sizes. Write today for complete specification data in new catalog No. AD-57.

Style U-1L Universal Adjustable Head provides 9" diameter drilling area.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U.S. DRILL HEAD...5 to 1.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

Production per disc increased over six times:

1. By change to disc with new [redacted]
2. By special use of large single-point diamond dresser

Grinding both ends and bottom of cast iron transmission cases. Machine is Gardner 179-72" Horizontal Disc Grinder.

. . . Another example where Gardner's combined knowledge of both machines and abrasives paid off profitably. Call the Gardner Man for a practical, economical solution to your flat surfacing problem.

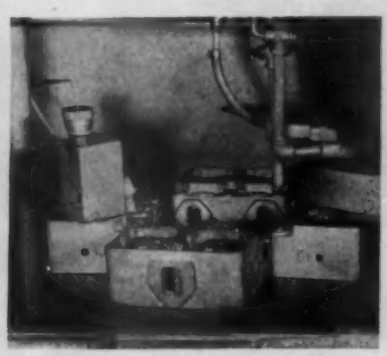
GARDNER

abrasive discs

BELOIT, WISCONSIN

Whatever your grinding job may be...

200 adjusting screw washers are ground on one side in one hour. Stock removal .025"; limits ± .001".

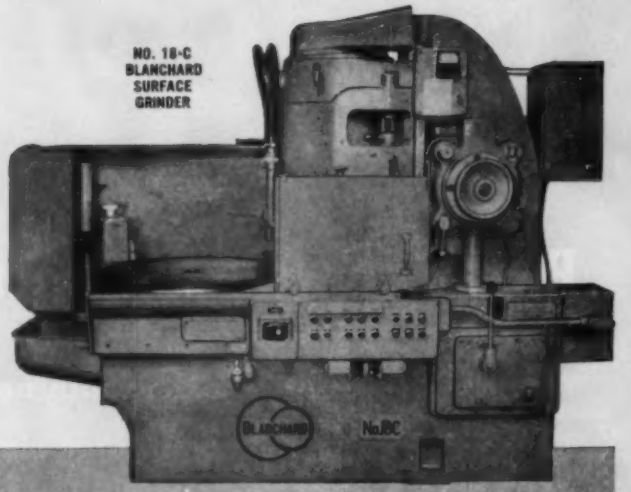


Tops of cylinder heads ground 21 per hour; stock removal 3/16" to 1/4". Bottoms 55 per hour; stock .012"; limits ± .001".

56 cast iron plates are ground on one side in one hour. Stock removal .140"; limits .001".

for best results...

The Blanchard No. 18-C Surface Grinder has the speed and precision that guarantees economical grinding on an endless variety of jobs. After the initial setup, the automatic cycle handles every operation from start to finish. The operator is freed to prepare the next load or to operate a second No. 18-C Grinder.



NO. 18-C BLANCHARD SURFACE GRINDER

Put it on the Blanchard

The 18-C Automatic Cycle...

Moves chuck to grinding position and starts it rotating

Starts wheel rotation and coolant pump

Provides rapid wheel approach to work

Engages power down-feed at preset rate

Changes to fine feed just before finished size is reached

Stops feed when work is to size — "sparks" out. Raises wheelhead

Stops wheel, coolant pump, and chuck

Moves chuck to loading position — demagnetizes chuck

Can be changed quickly to manual operation

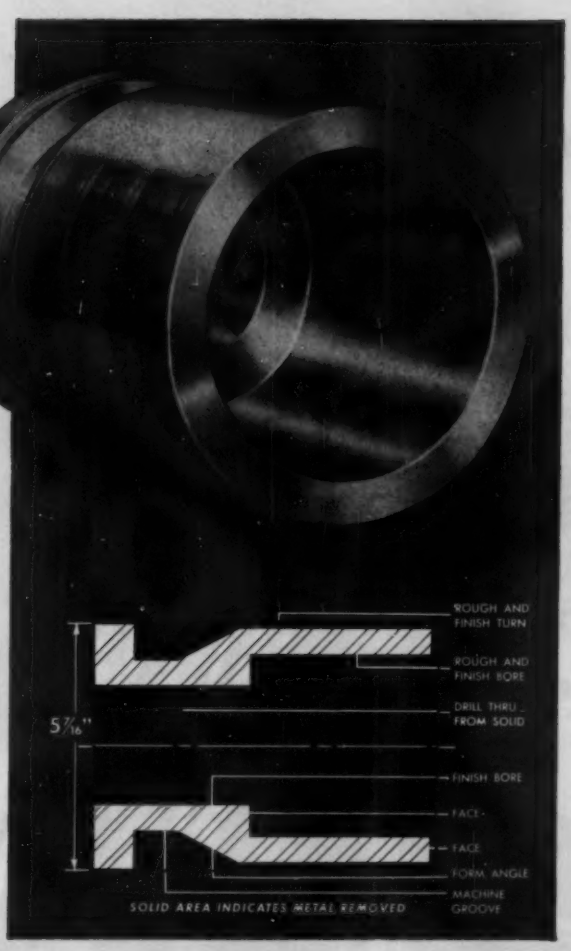
Automatically Controls Size!

Send today for your free copy of 18-C folder.

BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.



Let me show you how one of our P & J Automatics

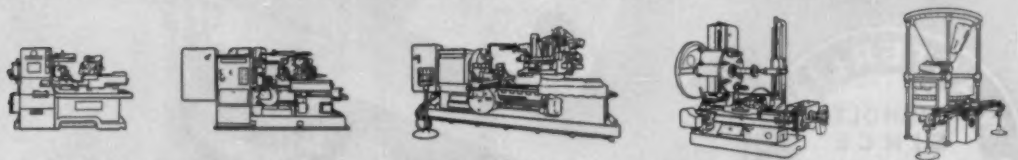
Hogged Out Over

31 POUNDS OF STEEL IN 6¾ MINUTES!

This job looked really tough. Machining from the solid meant unusually heavy metal removal . . . and our customer had to hold some pretty close tolerances and turn out parts *fast!* Here's what did the trick! Our new P&J Automatics have the extra power it takes to hog out metal fast *and* the extra rigidity that's needed to stay within the required limits under the heaviest feeds. You can see how teaming a machine like this with P&J Tooling, to save even more time by combining cuts, made it possible to complete one of these spools every 11 minutes. A new P&J Automatic can bring performance like this into your plant too. Send me your sample prints, and I'll show you how a P&J Automatic with P&J Tooling can help you turn out your toughest jobs faster, better and at lower cost. Write to Potter & Johnston Company, Pawtucket, Rhode Island.

HERE ARE THE FACTS:

PART: *Chuck Operating Spool.*
MATERIAL: *Cut-Off Bar Stock #34 Carbon Steel.*
REQUIRED: *Machine from the solid. Ten separate precision cuts.*
RESULTS: *A part completed every 11 minutes in a single, fully automatic cycle, removing a total of 40 pounds of metal.*
MACHINE: *P & J Model 6DRE-40.*

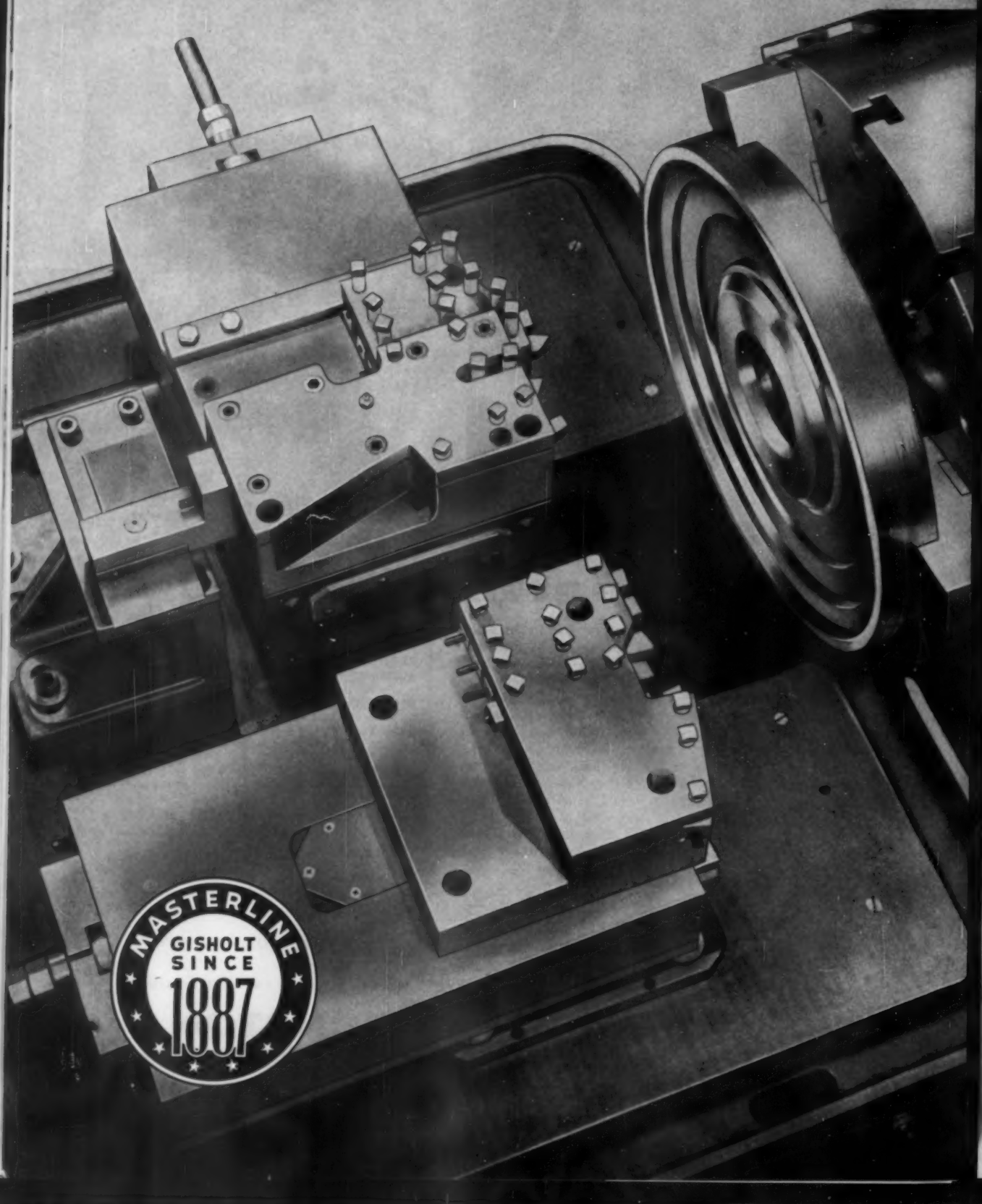


AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . GILDA PACKAGING MACHINES

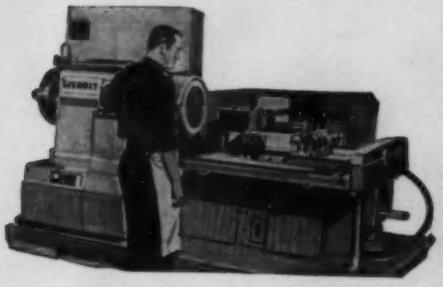
POTTER & JOHNSTON
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.
PRECISION PRODUCTION TOOLING SINCE 1898

This New GISHOLT MASTERLINE

SIMPLIMATIC AUTOMATIC LATHE may save you



the cost of a special machine



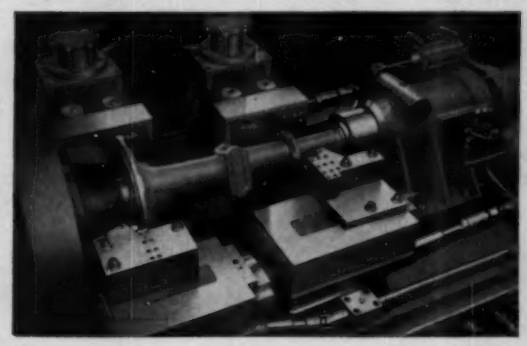
HERE'S WHY: the machine itself—headstock, bed, extra wide platen table—is *standard!*

Yet with the new Gisholt MASTERLINE Simplimatic Automatic Lathe, you have ample space for an *infinite* number of slide and tool arrangements. You can use front, center, rear and auxiliary slides—all moving at different feed rates—carrying enough tools to machine a maximum number of surfaces in a single chucking. All slides are easily mounted at correct angle to the work—keeping tool overhang to absolute minimum for increased rigidity and increased accuracy. And with the Simplimatic's table feed, tools can engage with the work or perform additional machining operations before actual slide movements begin.

Because the Gisholt Simplimatic is a standard machine, it is *easy* to set up, operate and maintain. In many cases, the automatic cycle frees the operator to handle additional units or perform other work. And the basic design is readily adapted for work-handling devices, which even further simplify the operator's job and speed production!

Ask your Gisholt Representative to show you how efficiently the Simplimatic can handle your problem parts—using a simple, standard machine transformed by addition of standard tool slides, tool blocks and chucking equipment—performing *special* machine functions at *standard* machine prices! Call him today for full information on the Simplimatic!

Simplimatic setup for machining both ends of tractor rear axle housings in one chucking. Four tool slides are used, two at the front and two at the rear of the platen table. Machining includes turning and chamfering, forming and straddle-facing, with tool relief provided for facing tools on the rear tool blocks.



Six different sizes of tough steel oil well cutter bits are handled with ease and efficiency by this tooling setup. All slides and tools are placed at correct angle to the work. Tools are mounted on riser plates, permitting pre-setting for quick change-over and adjustment. Rigid support eliminates chatter on heavy forming cuts.

READY NOW! Write today for new Catalog 1159-A on Gisholt MASTERLINE Simplimatic Automatic Lathe. Fully illustrated—shows 31 typical jobs.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

In the most forward position

...Hannifin valves

Our "NE" valve—one of several Hannifin 4-way directional air control valves. Ask your Hannifin man when to use it.

Persistent research is bringing Hannifin valves to the most forward position in the field of pneumatic controls. These valves are opening up new areas of progress for sequential automatic production.

The Hannifin valves you buy today incorporate the very latest results of never-ending testing and development. Versatility of application and dependability of operation are winning them their position of leadership.

See your Hannifin man. Find out for yourself why Hannifin air control valves are so rapidly becoming first choice for automatic operation.

AIR CONTROL

HANNIFIN

VALVES

For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 517 South Wolf Road, Des Plaines, Illinois.

Heller solid carbide Tools

give more because they "give" less!

GREATER RIGIDITY PAYS OFF: There's no spring or wobble as with carbide-tipped steel tools. So, longer life, higher speeds and smoother finishes are built into Heller Solid Carbide Tools.

CHECK THESE SPECIFIC ADVANTAGES! Heller Solid Carbide End Mills produce much finer finishes than tipped types. Heller Solid Carbide Drills increase production 40 to 50 times over high speed steel drills because of higher speeds. Heller Solid Carbide Reamers last as much as 50 times longer than steel reamers cutting hardened steels at Rockwell C-63.

RESHARPENING SERVICE ADDS FURTHER LIFE! Heller regrinds dull tools to restore them to original precision . . . at a fraction of their original cost.

COMPARE THE VALUE! Tested against high speed steel tools with or without carbide tips, Heller Solid Carbide Tools clearly prove that they cost much less in the long run.

Heller Tool Co.

NEWCOMERSTOWN, OHIO

America's Oldest File Manufacturer . Subsidiary of Simonds Saw and Steel Co.

HOLLER FOR HELLER

for better cutting at lower cost!

Whether it's solid carbide tools or job proved files you want, it pays to consider Heller first. **Oldest in filing experience, newest in cutting developments,** Heller is best equipped to match cutting tools to job requirements for maximum production at minimum cost.

SOLD EXCLUSIVELY THROUGH

Heller DISTRIBUTORS

"YOUR OUTSIDE TOOL ROOM"

SERVICE + STOCKS = SAVINGS

When you can't raise prices, you

for production men

This Avey machine is used in a jet aircraft plant on the West Coast for drilling, boring, and spotfacing the flanges and periphery of a jet engine component.

The two Aveydraulic units mounted horizontally have 12″ ram travel. The third Aveydraulic unit, mounted vertically, has 16″ ram travel and a 6-speed gear box with a speed range of 150 to 1800 rpm. The vertical column has an in and out traverse of 20″; moves to a minimum of 15″ and a maximum bolt circle of 55″.

The 60″ Electrodex table is equipped with a master index ring with two rows of bushings, 96, 49, and 8 indexes respectively. The three heads can be programmed to the indexing of the table.

Another example of how Avey combines standard units to meet special production requirements.

for management

You can close up shop, of course, when your primary customer puts the lid on your price at the point where you run out of profits. You can look for another customer. You can try another market where the customers are more reasonable. But these are all expensive cures.

A more realistic approach is to take preventive action now. For every pound of cure, you can invest an ounce of capital in Avey production machines which can reduce your operating costs immediately. Then you can meet your customer's demands and stay in business.

If your replacement reserves are limited, you can finance Avey equipment on a pay-as-you-produce plan. In many cases, Avey machines have returned their original investment so quickly that they earn clear profit within a year.

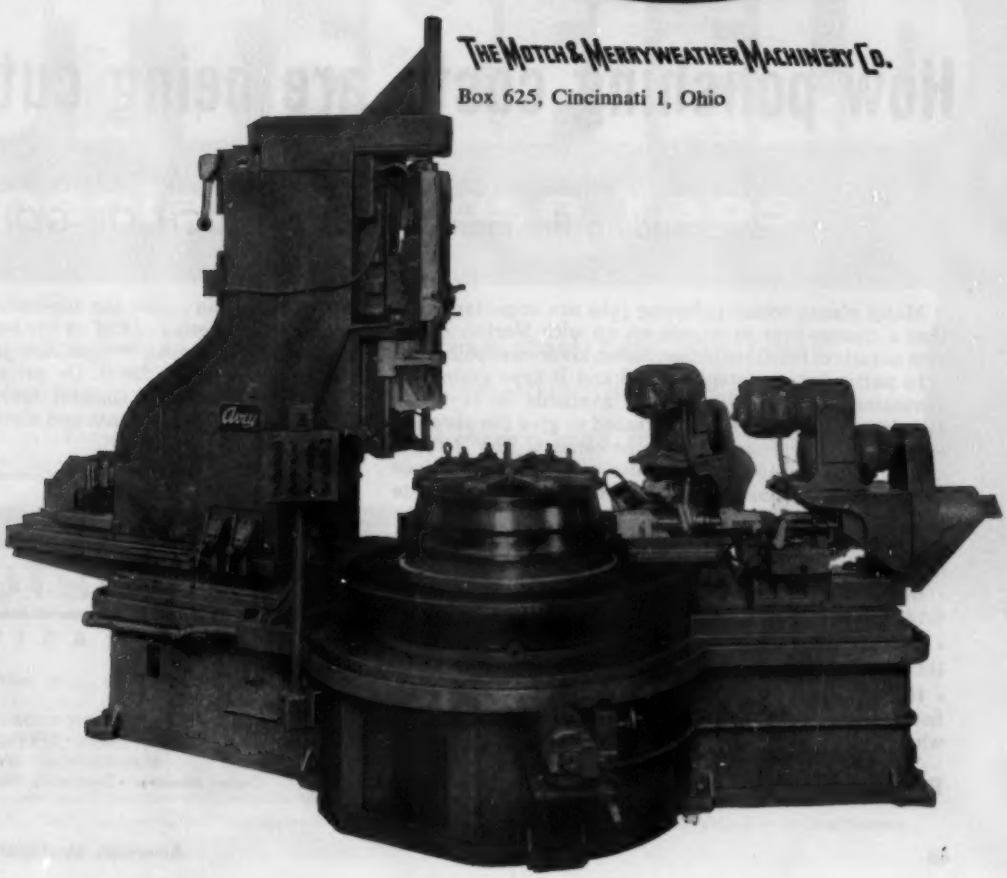
drilling, tapping, production machines

can still make profits

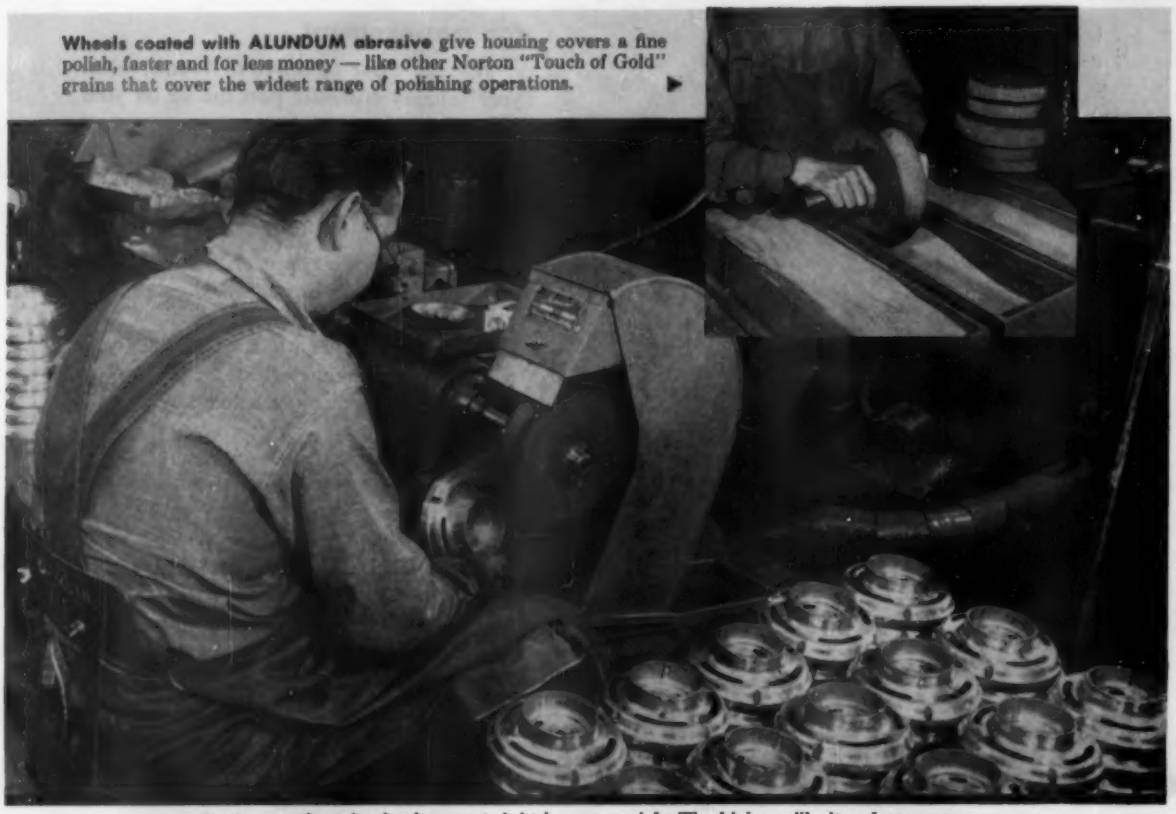
Avey DIVISION

THE MOTCH & MERRYWEATHER MACHINERY CO.

Box 625, Cincinnati 1, Ohio



Wheels coated with ALUNDUM abrasive give housing covers a fine polish, faster and for less money — like other Norton "Touch of Gold" grains that cover the widest range of polishing operations. ▶



Setting up the wheels shown at right is an easy job. The high capillarity of ALUNDUM polishing grains improves and speeds up the wetting process with glue or cement.

How polishing costs are being cut...NOW

Trend to wheels set up with ALUNDUM abrasive is spreading the money-saving "TOUCH OF GOLD"*

Many plants where polishing jobs are important find that a change-over to wheels set up with Norton ALUNDUM abrasives results in better, faster, lower-cost polishing.

In particular, preferences for S and R type grains are increasing rapidly. The S type, available in 14 to 90 grit sizes, is specially surface-treated to give the abrasive much greater adhesion to glue or cement. The R type, made in 100 to 240 grit sizes, also gets a special surface treatment, to improve its adhesiveness for use with glue only.

Typical advantages common to all ALUNDUM polishing grains include:

- **Uniform grain shape,** that assures a fast, uniform cutting action.
- **Uniform grain sizings,** with no oversize grains that mar the finish, no undersize grains to loaf on the job.
- **High capillarity,** assuring the easy absorption of adhesive that means longer lasting, better performing set-up wheels.

The booklet "Setting Up Metal Polishing Wheels and Belts" contains valuable facts on the various types of ALUNDUM grain . . . on the applications of canvas, leather or wooden wheels . . . and on the best means of preparing wheels, with cement or glue. Ask your Norton distributor for it. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

G-334

NORTON

ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS

Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION

Coated Abrasives • Sharpening Stones • Behr-cat Tapes

100% BUTTERFIELD

Special Purpose Taps

Ideal performers in metals like stainless steel, cast iron, brass, aluminum, magnesium . . . with different cutting angles and surface treatments . . . at standard prices from stock.

100% COMPLETE LINE . . . EVERY TOOL 100% INSPECTED . . . AND YOU GET

100% SERVICE FROM YOUR BUTTERFIELD DISTRIBUTOR

Butterfield also offers a complete line of taps, dies, drills, reamers, cutters, end mills, hobs and carbide cutting tools. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. **BUTTERFIELD DIVISION** • Union Twist Drill Company • Derby Line, Vermont.

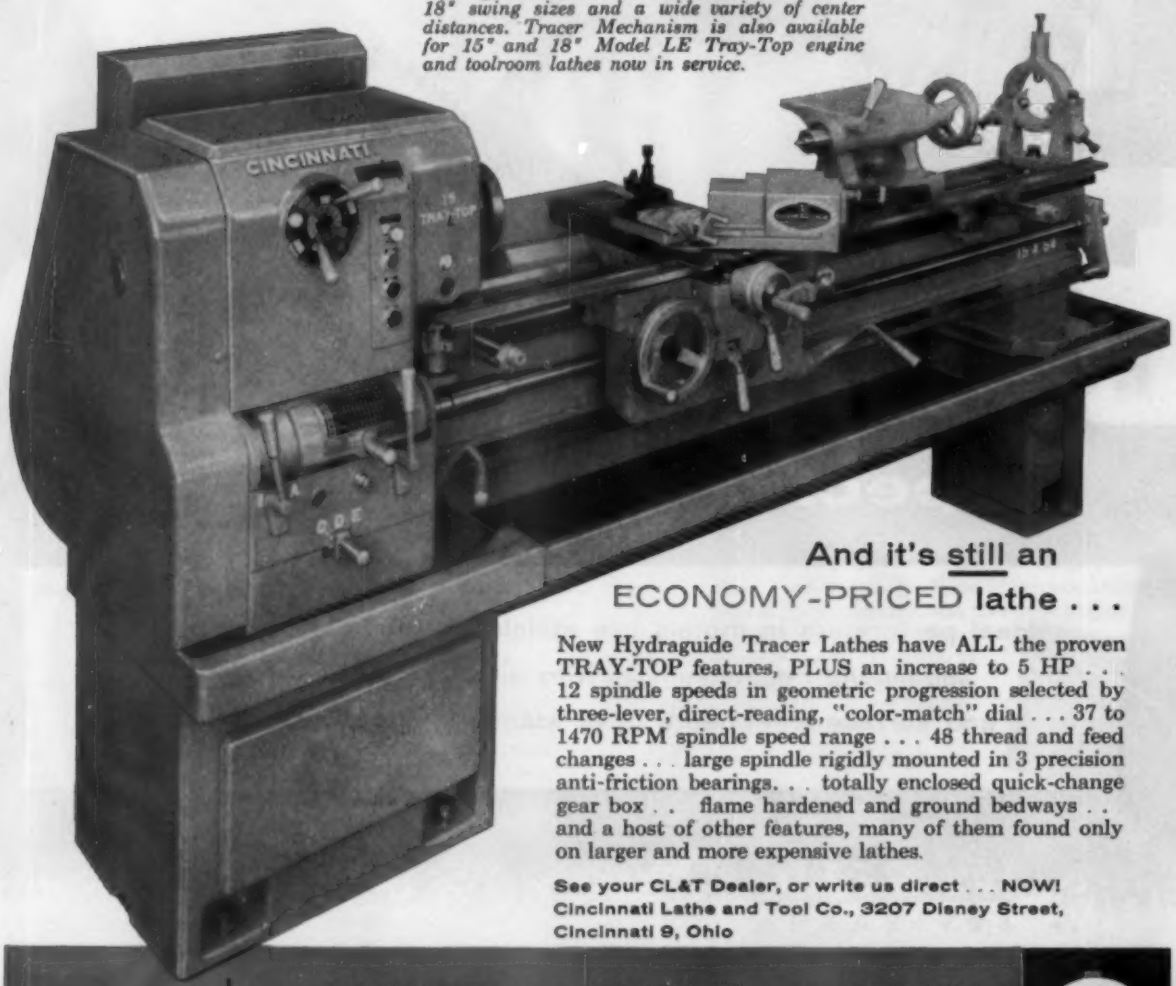
OUT IN FRONT

location of all controls, template and tools on the new

CINCINNATI HYDRAGUIDE TRACER LATHES

provides maximum convenience and safety for the operator, yet does not interfere with standard lathe operations. Just push a single button and you switch to full tracer machining, or back to standard. Compact design has all tracer mechanisms on the carriage . . . no added floor space is required. And the increase to 5 HP gives you greater productivity at every turn!

Hydraguide Tracer Lathes are built in 15" and 18" swing sizes and a wide variety of center distances. Tracer Mechanism is also available for 15" and 18" Model LE Tray-Top engine and toolroom lathes now in service.



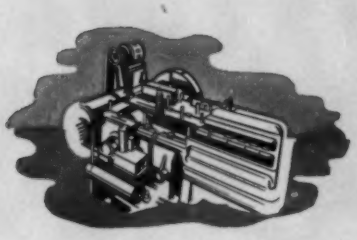
And it's still an ECONOMY-PRICED lathe . . .

New Hydraguide Tracer Lathes have ALL the proven TRAY-TOP features, PLUS an increase to 5 HP . . . 12 spindle speeds in geometric progression selected by three-lever, direct-reading, "color-match" dial . . . 37 to 1470 RPM spindle speed range . . . 48 thread and feed changes . . . large spindle rigidly mounted in 3 precision anti-friction bearings. . . totally enclosed quick-change gear box . . flame hardened and ground bedways . . and a host of other features, many of them found only on larger and more expensive lathes.

See your CL&T Dealer, or write us direct . . . NOW!
Cincinnati Lathe and Tool Co., 3207 Disney Street, Cincinnati 9, Ohio

center on **cincinnati lathes and drills**

ENGINE, TOOLROOM, TRACER AND FIXED GAP BED LATHES AND A COMPLETE LINE OF DRILLING MACHINES



"For three weeks their production was zero"...

A midwest plant was faced with a serious production problem in aluminum extrusion. The operation, on a ⅜" cold upset extruder, was to form a clinching cap for a metal screw. In three weeks of experimentation they did not produce one acceptable product, although they had tried a variety of piercing tool lubricants, including both oil and wax.

The plant foreman called in J. V. Ritz, a Sinclair Area Engineer. Mr. Ritz reports: "After studying their lubrication problem, I decided that Sinclair TRUKUT,® used in the neat form, would provide the correct lubrication. Three hours after they followed this advice, their machine was producing perfect caps at full capacity. *In fact, they produced more caps in a twenty-minute run than had been produced in the previous three weeks.*"

If you have a lubrication problem in your machining operation, call on the experience of a Sinclair Lubrication Engineer. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS and COOLANTS

Fewer Disc Changes—"More Use per Dollar"
MANHATTAN MOLDISCS

Every turn of a Manhattan Moldisc exposes a fresh, sharp abrasive surface—right down to the last usable part of the wheel. It won't load or glaze, whether the job calls for roughing *or* finishing . . . on weldings, castings *or* forgings. No wonder tests prove Manhattan Moldiscs are the most economical portable grinding wheels you can use on right angle grinders.

Manhattan Moldiscs are custom-made to meet your particular grinding and cutting requirements . . . for smoothing weldments, removing burrs, beveling edges on mild steels, stainless alloys, copper and aluminum. They're safer to use because they're light in weight, easy to control—and reinforced with special super-strength industrial fabric to prevent breakage.

Manhattan Moldiscs are available in a range of types from harder, stiffer bonds for fast roughing to more flexible and resilient bonds for fine finishing operations. Ask a Manhattan representative about Manhattan Moldiscs and other Manhattan high speed, heavy duty abrasive wheels for your operations. *Wherever* you need fast, safe metal removal and longer wheel life, you'll get "More Use per Dollar" when you specify *Manhattan.*

RM-739

GRINDING WHEEL INSTITUTE MEMBER

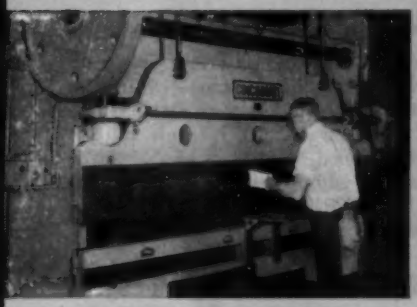
WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

A setup for punching is shown being made on this 10', 335 ton capacity Cincinnati Press Brake.



Tool boxes for New Holland Balers are shown being formed on this 8', 90 ton Cincinnati Press Brake.

This 10' Cincinnati Press Brake has a capacity of 150 tons, and is shown forming frame angles from $\frac{1}{4}$" steel.

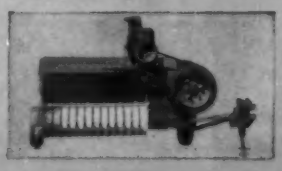
Punching and forming on accurate Cincinnati Press Brakes

. . . at NEW HOLLAND MACHINE CO., New Holland, Pa.

Three Cincinnati Press Brakes are profitable producers in this finely equipped plant. Some of the standard features which contribute to the accuracy of these versatile machines are:

- All-steel interlocked construction (no welds used as load supports).
- Rigid, deep beds and rams insure accurate, uniform performance.
- Centerline loading eliminates weaving of frame and cramping of slides and guides.
- Tilting ram adjustment is useful for fadeout work—micrometer indicators make it easy to reset ram parallel to bed.
- Automatic pressure lubrication system insures proper oiling.

Write Department **A** for Catalog **B-5**, and consult our Application Engineering Department about your production problems.



This Hayliner 68 Baler is just one of the many fine New Holland products made with the aid of Cincinnati Press Brakes.

Photos courtesy of New Holland Machine Co., New Holland, Pa.

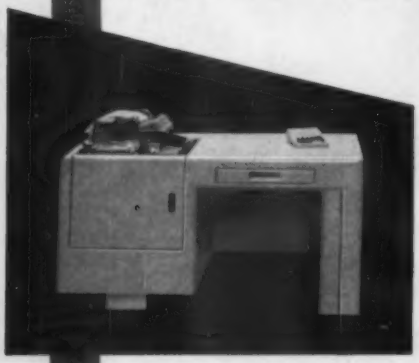
CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Here are the facts about

How Giddings & Lewis NUMERICORD system of machine tool automation boosts production, increases accuracy on a wide range of machining operations

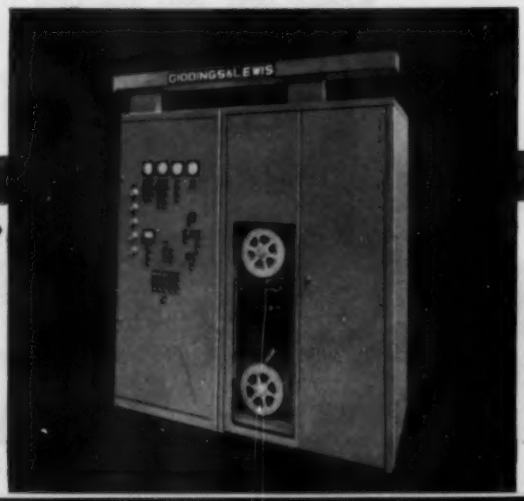


Pre-calculated data, tooling studies and feed rates in decimal form are accepted by preparation desk for punching paper tape.

Computing director converts decimal numerical data on paper tape into time-coordinated continuous electric signals . . . also accepts output data from standard computor program.

Magnetic tape recorder impresses all electrical signals from director on appropriate channels of a master magnetic tape.

Tape playback and machine control unit reads magnetic tape to control all axes and auxiliary functions of the machine tool automatically.



1 Is this type control system ready for production use?

Definitely! Giddings & Lewis machines have operated under NUMERICORD tape control for almost three years. They have proved that complicated, short-run jobs — some unmachinable by other methods — can be turned out with higher accuracies at greater production rates — in less factory space and with less time from drawing to finished part — with less total equipment. In fact, for *any* type of machine on which work can be programmed, Giddings & Lewis is ready to supply the proved advantages of NUMERICORD system of machine tool automation.

2 What is the scope of G&L's "hi-fi" machine tool progamming?

Giddings & Lewis is a pioneer in numerical control.

- The G&L NUMERICORD system for machine tool automation was originally developed in collaboration with scientists from the Massachusetts Institute of Technology.
- G&L will design, build and install all equipment; then fully train your personnel in the operation of complete numerical control systems including all functions — programming, data processing, tape preparation and machine control.

3 How much will NUMERICORD cost?

While far more versatile, NUMERICORD's first cost is not as high as machines with one-to-one tracer control. Actually, of course, the correct basis for judging the economics of such an investment is *cost per machined piece*. When correctly applied, NUMERICORD can reduce this figure spectacularly by minimizing set-up time, increasing machine capacities, running equipment continuously, repeating without error, improving tool life, and reducing rejects caused by operator's error. It has been estimated that production capacity with numerical control is three times that of current methods in one-half the space. And to hold your investment down, G&L will make magnetic tapes for you — you need purchase our machine-control play back and the necessary machine tool or tools.

numerical control!

4 Are machines *now* available to make the most of NUMERICORD?

Yes. The following Giddings & Lewis machine tools can be programmed for discrete position or path control: Horizontal Boring, Drilling and Milling machines (table, planer and floor types); planer-millers in various multiple cutting head arrangements; skin and spar milling equipment with single and multiple head arrangements; VARIAX (variable axis control contour milling machines); vertical boring mills; Kaukauna vertical turret lathes; Cincinnati Bickford radial drilling equipment using automatic table positioning; Kaukauna horizontal and universal boring, drilling and tapping machines.

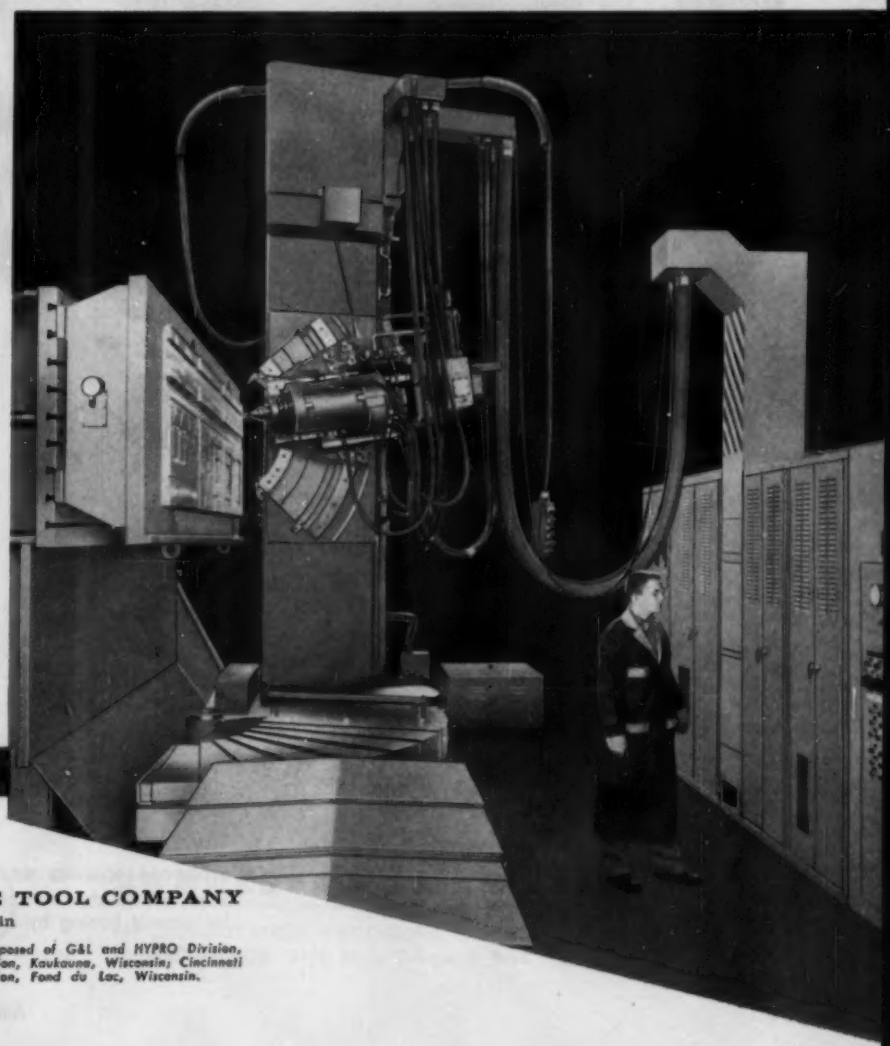
Consider the VARIAX contour milling machine, shown below. Coupled with NUMERICORD, this is the only machine tool on the market today that provides *five* simultaneously and automatically controlled axis motions.

And through their Davis Boring Tool Division, G&L can tool all machines for any program.

•

Don't be confused by all the current publicity on numerical control. Come to G&L for straight-forward answers to any questions. At no obligation to you, G&L will evaluate the feasibility of this equipment for your operation and recommend programming procedure. G&L also offers complete programming service for G&L tools and their associated numerical control systems. And for a preliminary idea of how NUMERICORD works on production machines, ask your distributor for a private showing of color-sound moving pictures featuring present applications.

•



VARIAX contour milling machine designed for high speed contour milling of aircraft structural components and other similarly complex parts in a variety of configurations. Machine movements and functions are fully automated with NUMERICORD for maximum operating efficiency.

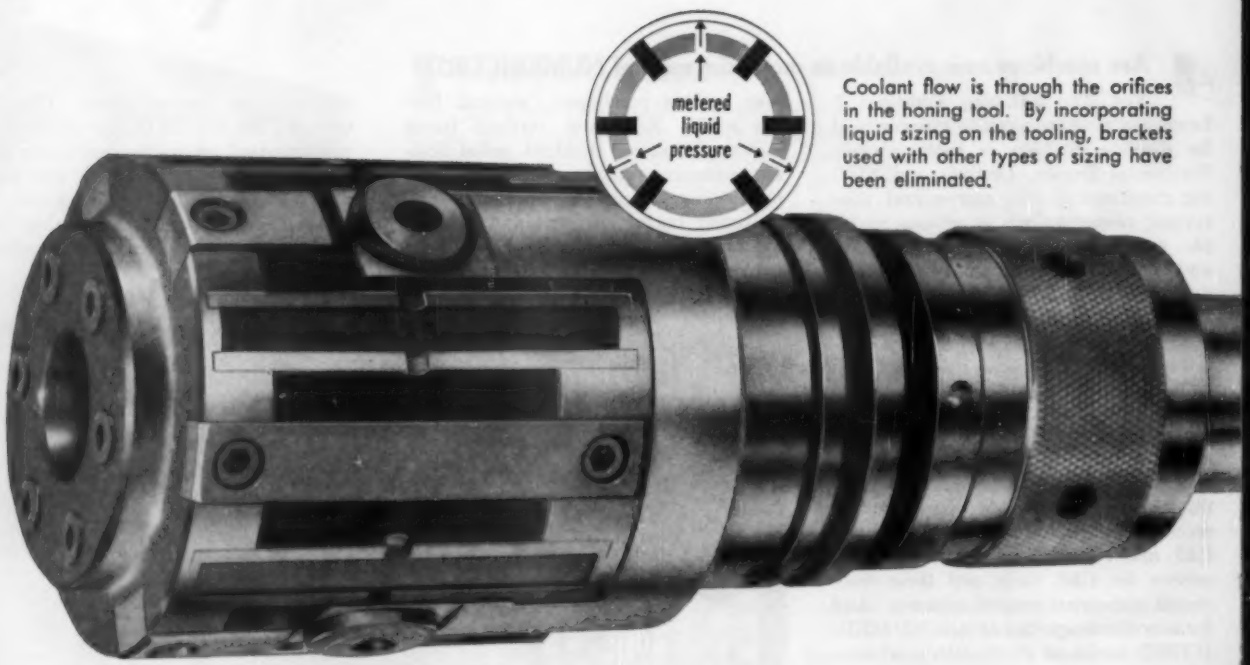
G&L HYPRO

GIDDINGS & LEWIS MACHINE TOOL COMPANY

Fond du Lac, Wisconsin

Builders of the world's most modern machine tools and composed of G&L and HYPRO Division, Fond du Lac, Wisconsin; Kaukauna Machine & Foundry Division, Kaukauna, Wisconsin; Cincinnati Bickford Division, Cincinnati 9, Ohio; Davis Boring Tool Division, Fond du Lac, Wisconsin.

new liquid sizing



Coolant flow is through the orifices in the honing tool. By incorporating liquid sizing on the tooling, brackets used with other types of sizing have been eliminated.

CUSTOM-HONING SERVICE for special short-run applications. Send us your short-run pieces, with specifications and requirements for prompt honing by expert technicians.

automatically gauges full length of honed bores

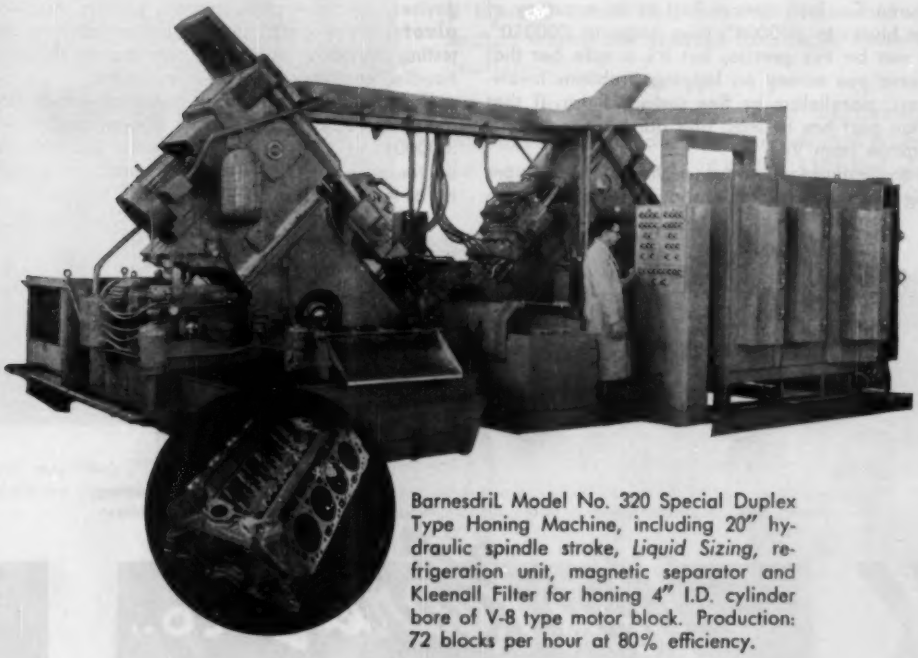
Barnesdril honing engineers have developed an improved method for sizing honed bores, as a part of the honing machine cycle. Referred to as Liquid Sizing, this method automatically gauges the diameter of honed bores throughout their full length as honing progresses.

Sizing is accomplished by metering liquid pressure, directed against the cylinder wall through orifices in the honing tool. As honing progresses, the bore increases in size, causing the pressure to decrease. When the pre-selected bore size is indicated over full length of honed bore by the balanced pressure, a limit switch terminates the honing machine cycle, permitting the tool to complete the stroke and withdraw from the bore.

This new Barnesdril Liquid Sizing method offers the following advantages:

1. Sizing the entire length of bore.
2. Better heat control as a result of directing the flow of coolant through the honing tool orifices to the most critical point.
3. Continual stone flushing, giving longer stone life and better micro finish control.
4. New Barnesdril Plate Type Honing Tools are utilized.

Contact your Barnesdril representative for full details on new Liquid Sizing, or write us directly. Years of engineering experience dealing with honing problems enable Barnesdril engineers to supply the most practical methods and equipment to solve your hole finishing problems.



Barnesdril Model No. 320 Special Duplex Type Honing Machine, including 20" hydraulic spindle stroke, *Liquid Sizing*, refrigeration unit, magnetic separator and Kleenall Filter for honing 4" I.D. cylinder bore of V-8 type motor block. Production: 72 blocks per hour at 80% efficiency.

50th year

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

VK

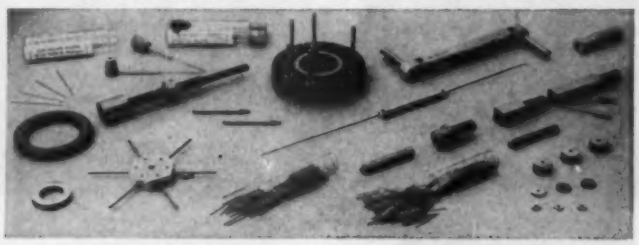
USE OUR SKILLS on YOUR LAPPING PROBLEMS

If that tough production part has Gage Characteristics, try the Van Keuren Precision Lapping Service--

The Van Keuren Co. laps optical flats to an accuracy of .000001", gage blocks to .000004", plug gages to .000010". Your job may not be this precise, but it's a safe bet that VK skills can save you money on lapping problems involving size, flatness, parallelism or fine surface finish. If that tough production part has at least one gage characteristic, ask for a quotation from VK.

We lap flat and cylindrical work in both metals and nonmetals. Sealing rings and plates for pumps and pressure devices, precision pins, spacers, pistons, punches, ***carbide pivots,*** valve parts, instrument components and parts for testing inspection equipment, are among the customer items handled economically here in our plant.

If you require lapped or polished surface finishes in the order of .5 to 5.0 RMS, or dimensional tolerances from .000001" to .0001", The Van Keuren Co. can probably help on the problem. The "rule of thumb", as suggested above, is "at least one gage characteristic."



Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

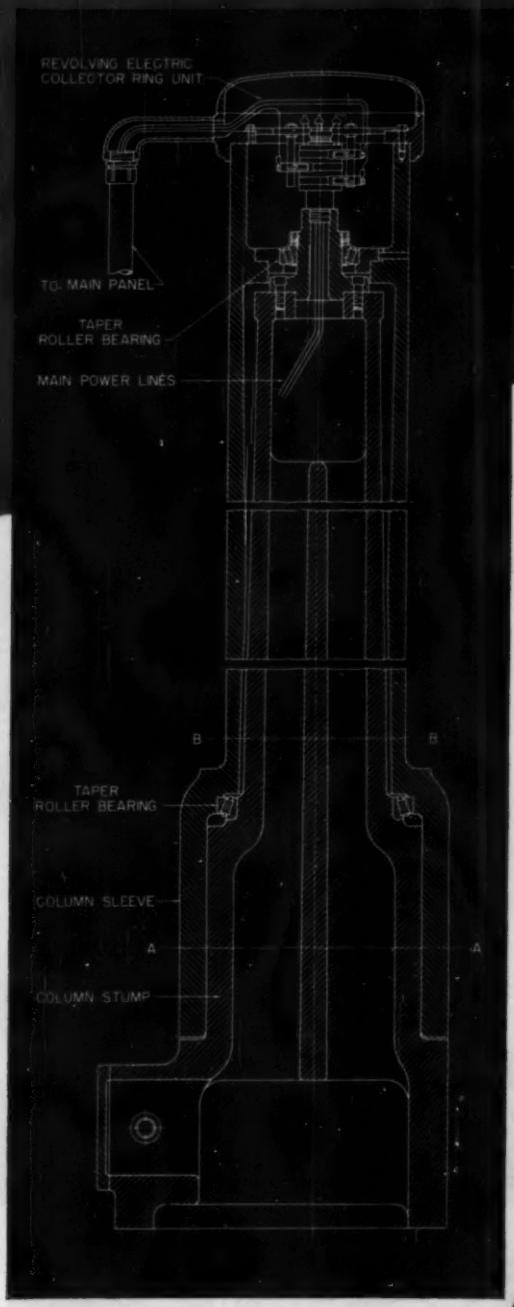
38th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

Rigidity Increased 50%



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

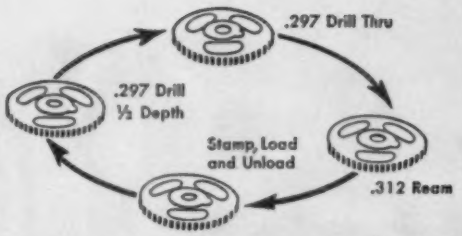
Large Timken bearings at top and bottom when preloaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.

Write for Bulletin No. 328 for the complete story of More and Better Work at Lower Cost.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

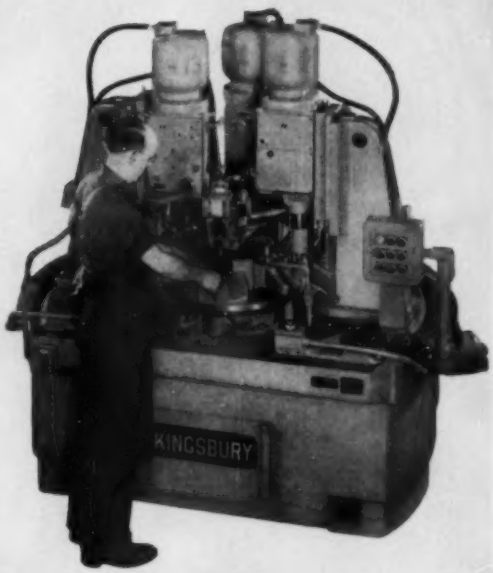


450 PER HOUR GROSS

- DRILLED
- REAMED
- STAMPED

— on this high production

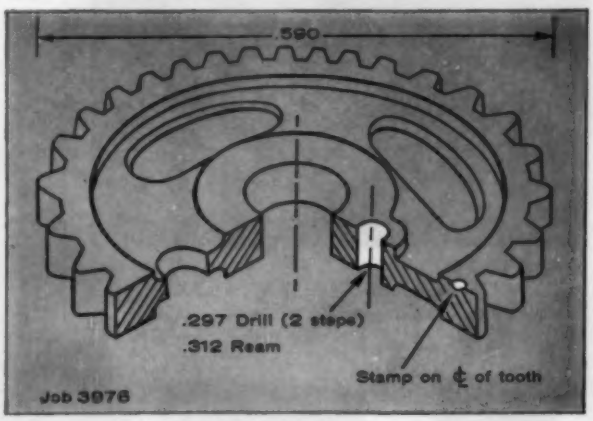
KINGSBURY



This 4-station Kingsbury has a 72" semi-circular base, 20" index table, JIC electrical controls (not shown)

This machine has three single-spindle vertical units, two for drilling and the third for reaming. Drilling in two steps shortens the time cycle, thereby increasing the hourly production. A special mechanism at the operator's station stamps the gear. The operator has only to load the work, push a button, unload completed work. All operations are done automatically at each station.

Kingsbury indexing automatics are built for jobs as simple as this one, to complex ones involving a dozen or more drilling, tapping and other operations. In every case, the customer gets a fully tooled machine, ready to produce at the rates he wants. If you have operations like these, we'd like to show you how economically they can be done on a Kingsbury. Kingsbury Machine Tool Corporation, Keene, N. H.



KINGSBURY
INDEXING AUTOMATICS
for high-production drilling and tapping

Air portable disc sander using "81 Coat" Speed-Wet Metalite Discs to speed grinding of die-marks on refrigerator front sheets.

New SPUR ACTION abrasive discs give 2/3 more production

Here is the long-sought answer to both production and cost problems . . . new abrasive belts and discs that not only cut faster—but actually last longer on tough production runs. With the "81 Coat" you get "spur action"—hundreds of rougher, tougher cutting spur points per square inch for faster stock removal. And the strongest resin bond ever gives greater endurance to grinding heat. It's breaking all records for longer mileage. Ask your Behr-Manning representative to prove that "81 Coat" Abrasive Belts and Discs outlast all others by 50%.

BEHR-MANNING CO.

TROY, N. Y.

A DIVISION OF NORTON COMPANY

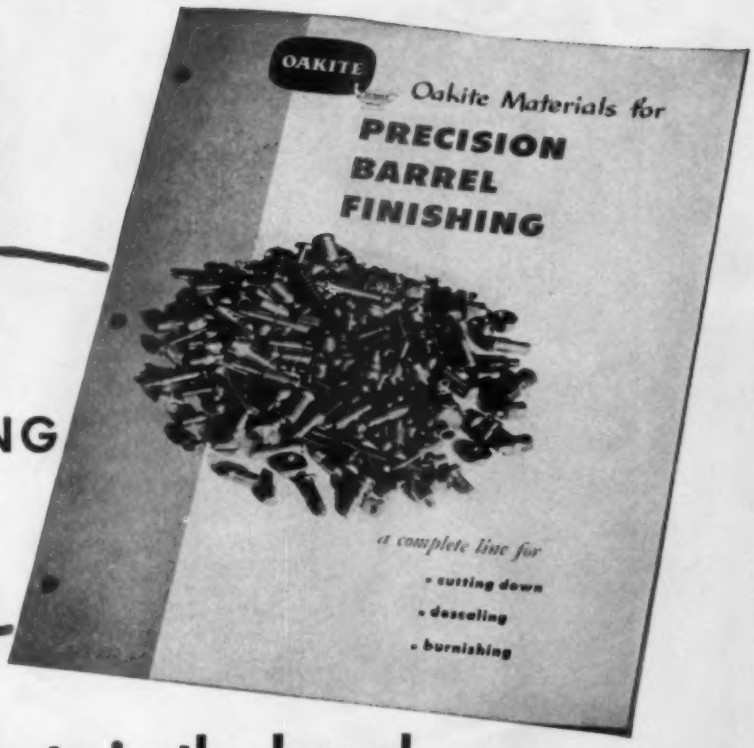
NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U.S.A.

BEHR-MANNING®

At the Metal Show
Visit Oakite Booth 247

HERE'S
AN EXCITING
GAME



PUT your products in the barrel
TAKE your profits out

A great way to save money is to barrel finish metal parts by the hundred instead of manually finishing one part at a time.

Next time a job of grinding, deburring or buffing proves too costly on a wheel, try it in a barrel. The results are often so surprising that barrel finishing becomes an exciting and profitable game.

One Oakite customer changed to barrel methods to deburr curved stainless steel strips that are 14 inches long. The cost for deburring 20,000 strips was reduced from $3,000 to $125.

FREE For a copy of *"Precision Barrel Finishing"* write to Oakite Products, Inc., 18 Rector St., New York 6, N. Y.

OAKITE
SPECIALIZED INDUSTRIAL CLEANING
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada
Export Division Cable Address: Oakite

"We grind no axe... and really have no need to." After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE

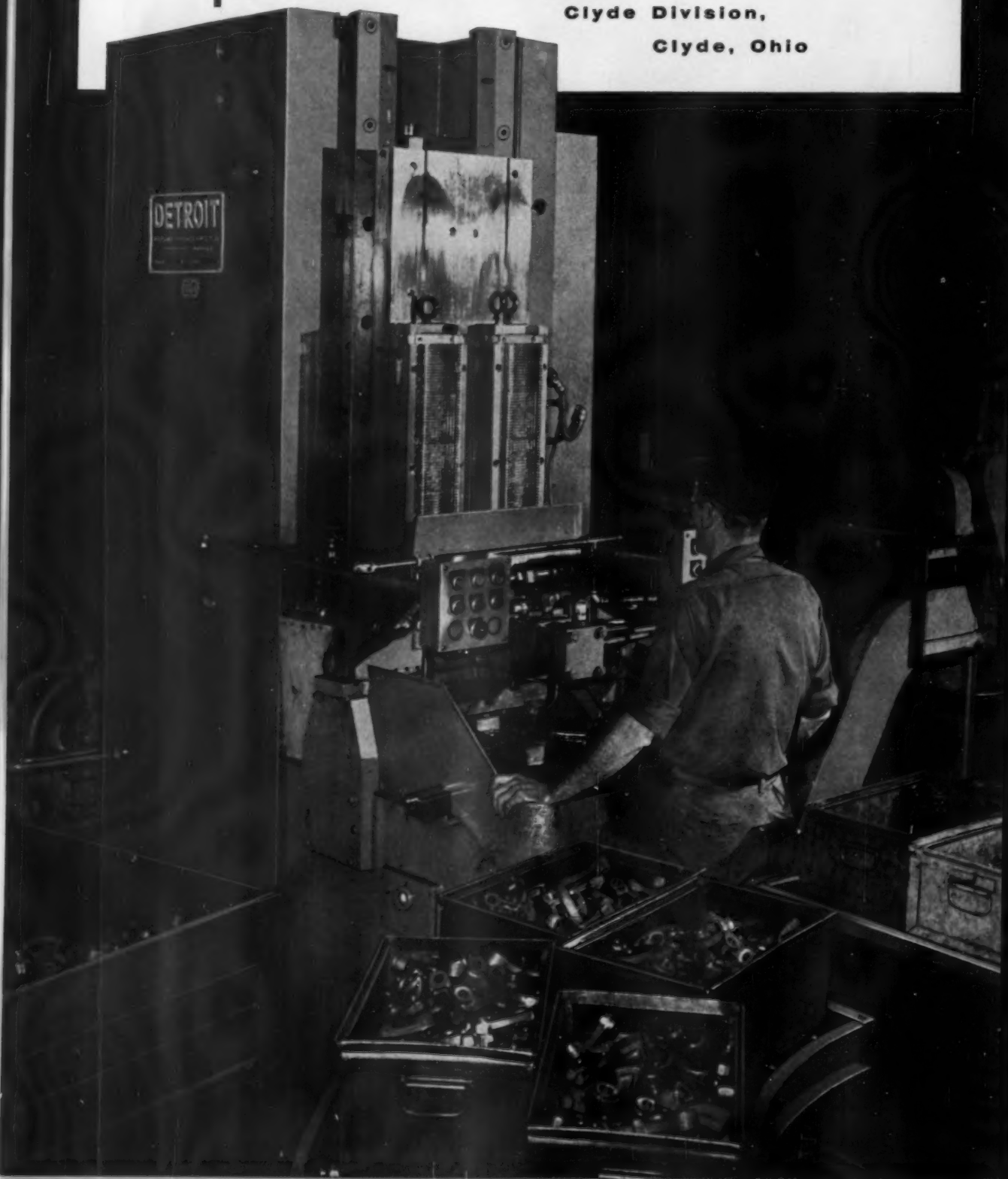
DETROIT BROACH

In the Production Picture with Industry's Leaders

LOCATION: Whirlpool CORPORATION

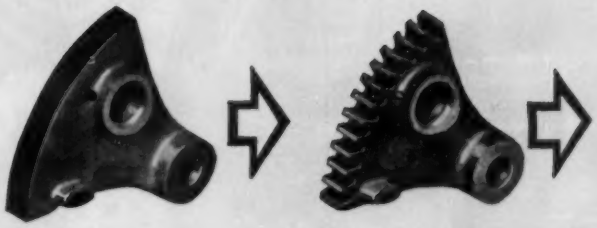
Clyde Division,

Clyde, Ohio



....BROACHES 300 SECTOR GEARS PER HOUR

for RCA Whirlpool automatic washers



Whirlpool Corporation's Clyde Division in Clyde, Ohio, contains well over a million square feet of manufacturing area for production of automatic and conventional washers. The division employs approximately 2,500, and utilizes the most modern methods and equipment. One example of progressive production methods is the machining of automatic washer sector gears on a Detroit Broaching Machine. Here are the job facts:

PART: Sector gear, gray cast iron

MACHINE: Detroit Vertical Single Ram, 10-ton broaching capacity, 54-inch stroke.

OPERATION: Broach outer radius and thirteen 10-pitch, 20 degree involute gear teeth.

CYCLE: Load two parts over locating pins; cycle-start causes table to travel forward, actuating hydraulic bridge clamp; clamping action energizes pressure switch, which causes ram to descend, broaching both parts; limit switch at bottom of stroke signals ram to rise, fixture to unclamp and table to shuttle out for unloading and reloading.

STOCK REMOVAL: Depth of cut—.234" to .236".
Length of cut—19/32".

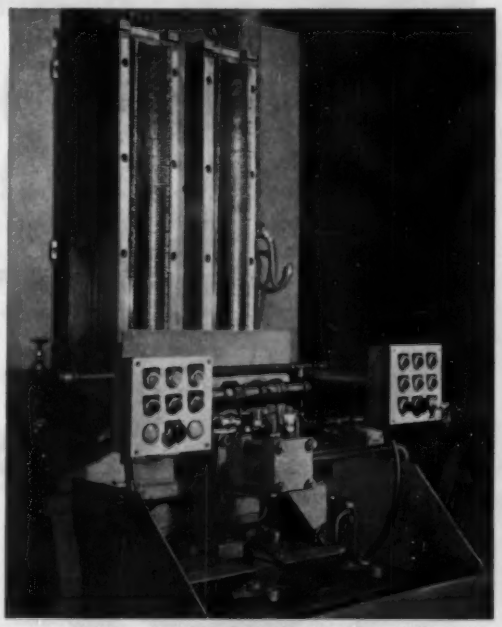
HOURLY PRODUCTION: 300 parts at 100% efficiency.

This Detroit machine offers many important features not found on similar equipment, which make possible high production, close tolerances and fine finishes. One example is the oversize table which accommodates multiple tooling for the two station operation illustrated. Many other features, including an extremely efficient hydraulic circuit are illustrated in an informative bulletin on Detroit Vertical Single Ram Broaching Machines. Write for your copy, or send details of your production machining problem for prompt engineering recommendations.

Write for these Broaching Machine Bulletins:

- Vertical Single Ram
- Vertical Twin Ram
- Vertical Pull Down
- Horizontal Internal
- Horizontal Continuous
- Horizontal Surface
- Hydraulic Presses

RCA Whirlpool "IMPERIAL" Model Automatic Washer.



Oversize table, a feature of all standard Detroit Broaching Machines, is readily tooled for multiple as well as single station operations. Tooled and fixtured by Detroit specialists, this single slide machine broaches two parts with each ram stroke. Detroit Broaching Machines are furnished with any degree of automation required, and are always designed to be economically converted for part changes.

DETROIT BROACH & MACHINE COMPANY

DEPARTMENT A-10 • ROCHESTER, MICHIGAN

machine tool accessory manufacturer reports:

82% time savings

...WITH NEW LODGE & SHIPLEY POWERTURN COPYMATIC

In the production of machine spindles, the Master Manufacturing Co., Hutchinson, Kansas, is highly enthusiastic over the performance of their new POWERTURN 90° COPYMATIC.

The example cited to the left is outstanding evidence of COPYMATIC productivity. Nevertheless, on a wide range of production, Master Manufacturing finds time savings that average out to a 35% increase in production. Such performance is a characteristic of Lodge & Shipley COPYMATICS, known throughout the industry for accuracy, versatility and high speed production.

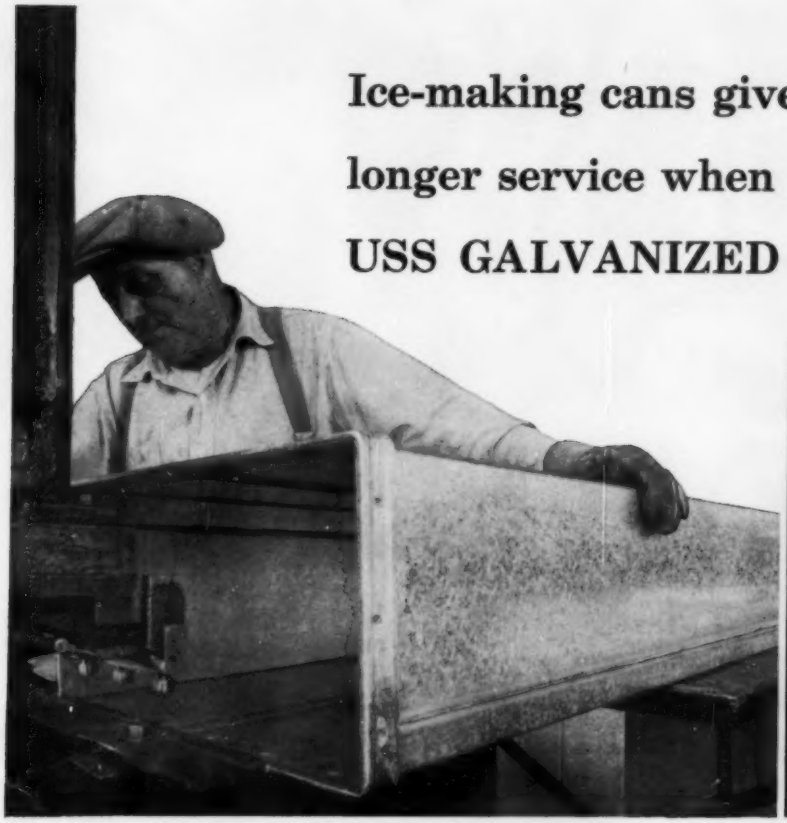
We find it easy to prove COPYMATIC superiority with case history material and actual demonstrations. May we give you the facts?

Write for Bulletin L-101 to: The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio

Lodge & Shipley

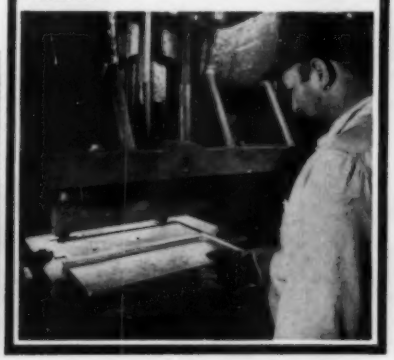
your LODGE-*ical choice!*

Ice-making cans give better, longer service when made of USS GALVANIZED STEEL SHEETS



This 300-pound can, shown during final fabrication stages, uses 14-gage bottom sheets and 16-gage sides of USS Galvanized Steel.

In this heavy press, a sheet of USS Galvanized Steel is formed into the bottom of a large can. The smooth, even zinc coating of this sheet will not crack or chip under this severe forming operation.

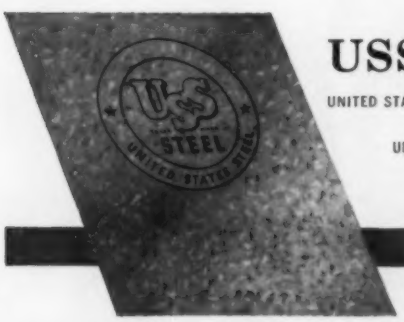


Refrigeration is something taken for granted by the average American, yet, ice is needed every day in the handling and also transportation of perishable foods, and is readily available in either block, cubes or processed form from the manufacturer or from vending stations.

The Ohio Galvanizing & Manufacturing Company, Niles, Ohio, has been manufacturing cans to make block ice since 1902, and selling them to an international market. They use USS Galvanized Steel Sheets extensively for the ice cans, and have found these sheets with their tightly adherent zinc coating to be a wise choice. In making ice, these cans are constantly subject to the corrosive effects of water and brine plus damage due to rough handling.

In the manufacture of galvanized steel ice cans as well as many other fabricated items, the need for uniformity of the sheet and the zinc coating on it is answered in USS Galvanized Steel Sheets.

USS Galvanized Steel Sheets are uniform in flatness, ductility, and thickness. They can be bent, cut, stamped, formed, soldered or welded without danger of chipping, flaking or other failure of the coating. For more detailed information on the versatility of USS Galvanized Steel Sheets, get in touch with the nearest District Sales Office of United States Steel.



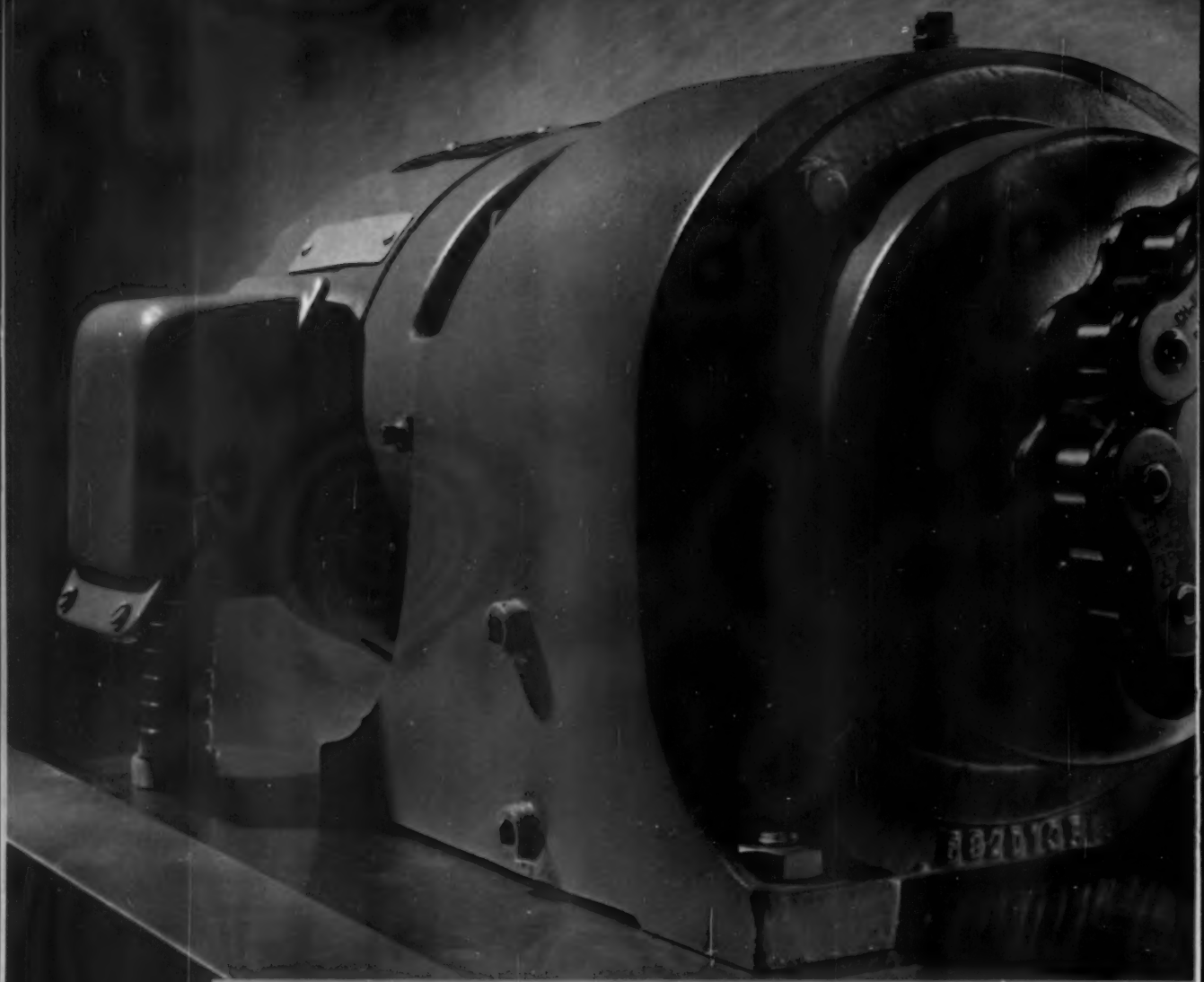
USS GALVANIZED STEEL SHEETS

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

UNITED STATES STEEL

A great gear-motor



NEW integral unit

Compact, one-piece unit has complete, easily removable motor, machined-in alignment.

NEW all-motor unit

Providing wide application flexibility, motor change may be accomplished without disturbing gear.

General Electric's

NEW

gear-motor line

Now, you can meet all your low-speed drive requirements from a brand new line of General Electric packaged power transmissions. This 3-unit line is based on a new, completely simplified, helical design that has evolved from General Electric's 25 years of gear-motor engineering and application experience. And it's a line that can provide you with important, 3-way savings on all low-speed applications.

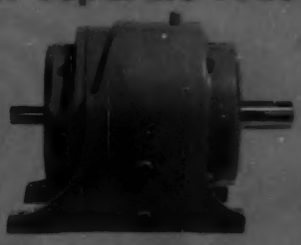
1. **Greater reliability:** This new line incorporates the most advanced gear manufacturing methods and all units are factory tested before shipment. In addition, you benefit because you purchase both motors and gears from a single manufacturer.

2. **Easier Maintenance:** A cinch to assemble and disassemble, alignment is machined right into each unit. Gear components may be carried in stock as sub-assemblies, minimizing downtime for normal repair.

3. **Reduced inventory:** You can reduce your inventory with no sacrifice to your operating continuity. Parts standardization and interchangeability permit a basically lower inventory investment.

This new line was developed to keep pace with the new requirements and wider applications of gear-motors brought about by advanced manufacturing techniques. *Get complete information from your nearest Apparatus Sales Office or Distributor—or write for bulletin GEA-6704, containing line highlights, to General Electric Co., section 851-6, Schenectady, N. Y.* Gear-Motor and Transmission Components Dept.

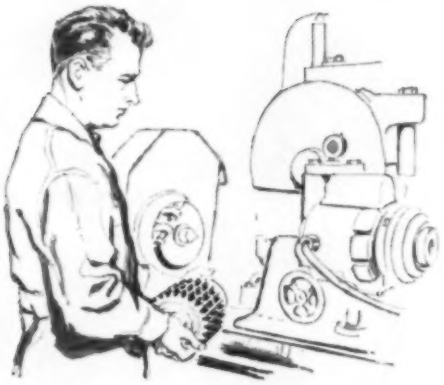
NEW separate reducer



Unit can provide a variety of output speeds with change of belt or chain rates.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Before joining Bay State ex-Marine Ben Guy learned trouble-shooting the hard way. He steers clear of guesswork, digs for facts and analyzes them to come up with answers that really work.

He upped crush-form grinding efficiency 500% for Western Gear Works

Western Gear Works, of Belmont, Cal., had the kind of trouble that could put a good production man on tranquilizers. In their crush-form grinding operation, so many gears had to be junked because of heat checks that total saleable production was only 9 good gears a day.

Bay State sales engineer Ben Guy was called in and diagnosed the trouble as soon as he got the specification of the wheel they'd been using. After making minor adjustments to the machine, he specified a Bay State wheel that ran cooler and cut cleaner. Result: production zoomed 500% to 45 good gears every 8 hours. Heat checks and loss of tolerance were totally eliminated.

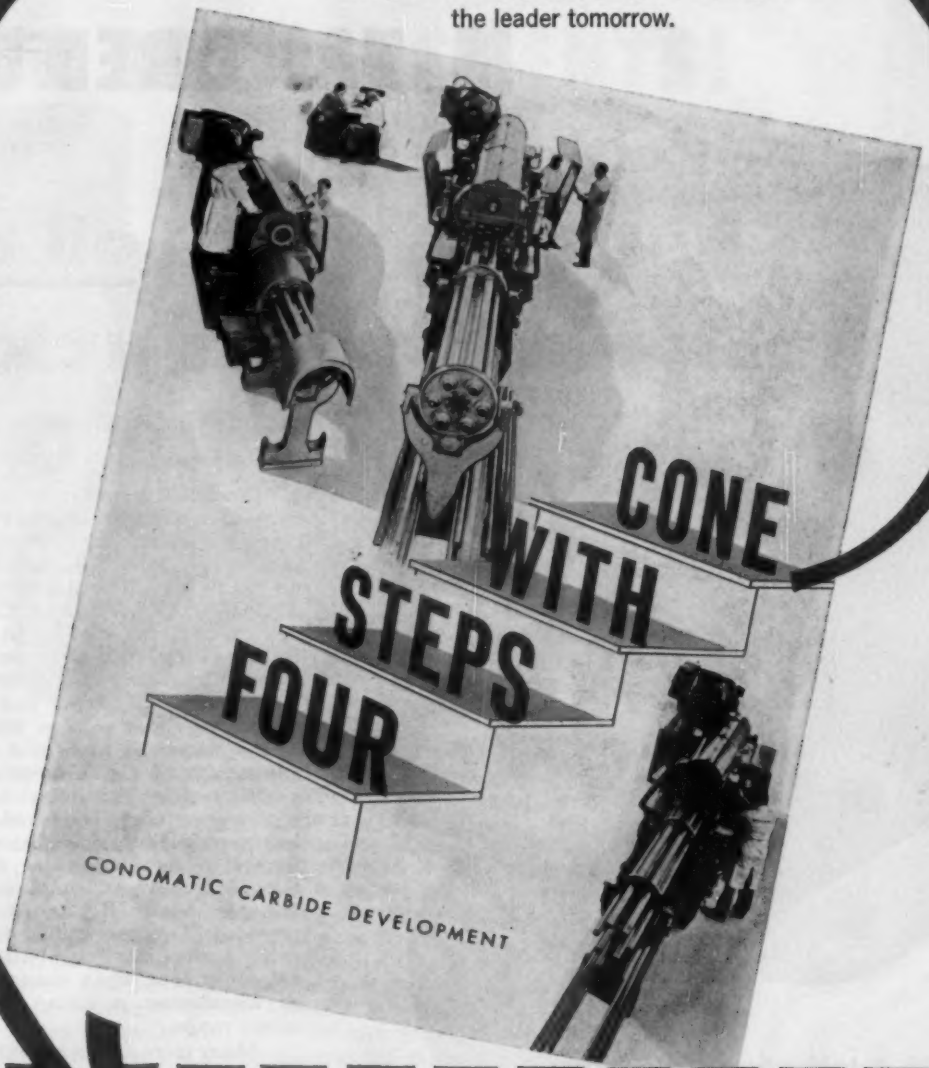
Bay State representatives don't solve all their customers' problems as easily as this, of course, but the Western Gear story shows how important it is to have an abrasive man on tap who really knows his business. If you want careful, cost-conscious recommendations on your grinding problems, you'll find the Bay State man in your area has been thoroughly trained to give you that . . . and more.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities. Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario.

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.



Write for your free copy of this important booklet today!

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

CINCINNATI PRECISION IS TAILORED* TO

At the Metal Show see the INDUCTRON

simultaneously hardening both ends of Chrysler push rods. Rods are 5/16" x 11.58", SAE 1056 steel. Special fixture feeds rods through work coils into oil quench.

all new inductron

INDUCTION HARDENING MACHINE

Cincinnati's new Inductron® offers more advantages in performance, flexibility, ease of operation, and reliability of component life than any similar equipment previously offered to industry. Built in 15, 30 and 50 KW capacities, these machines operate at frequencies up to approx. 1000 KC for faster heating, thinner case, greater freedom from scale and distortion.

All units are wired and equipped to operate on either voltage, 220/440. Power, in the smoothest form of d.c. possible, is adjustable over the entire range, using only a basic rectifier circuit with low-cost, long-life rectifier tubes. The standard Inductron has a manually adjustable output transformer to accommodate a wide range of workpieces. A self-contained, externally variable output RF transformer can be provided at extra cost. The feed back (grid drive) system is self-regulating and requires no adjustment when changing work coils or transformer position, over the entire power range.

Many more design advantages—in component and circuitry construction, in controls and instruments—are incorporated. Throughout, the new Cincinnati Inductron assures you highest operating efficiency with maximum component life.

***BUILDING BLOCK CONSTRUCTION**

CINCINNATI

flamatic and inductron *hardening machines*

in Action at the **METAL SHOW**

SELECTIVE HEAT TREATING YOUR REQUIREMENTS!

all new flamatic

FLAME HARDENING MACHINE

High machine flexibility for the flame hardening of an even wider range and diversity of parts . . . *at greater-than-ever-economies* . . . is the keynote of this new Cincinnati Flamatic®.

The standard machine is built with a functional, flat bed design—having large, open area—on which any one of a wide variety of tooling and work-handling systems can be located. Thus the basic machine becomes highly adaptable to a large range of work that previously fell in the "special or modified-standard" machine class.

Other provisions include precision electronic temperature control system; compact, all-inclusive control cabinet; integral quench tank with high-capacity heat exchanger, quench agitation system, and large discharge conveyor that integrates with plant conveyor systems.

As before, Flamatic gives you a wide choice of fuel gas, easy set-up and operation, automatic heating to pre-set temperature, uniform results, with top calibre construction that provides the utmost in freedom from downtime.

When you have parts requiring selective surface hardening or other heat processing, you'll profit by talking to Cincinnati . . . builders of *both* flame and induction hardening machines. Call in a Process Machinery Division field engineer. He is ideally equipped to evaluate your needs and give you unbiased recommendations as to the most economical and efficient equipment for your work.

At the Metal Show see the FLAMATIC

simultaneously spot hardening both cup and pad sections of automotive rocker arms, six parts at a time . . . a typical adaptation of the standard unit. Part material is nodular iron. Timed cycle is automatic, except for loading of the fixture.

BOOTH NO. 1798
CHICAGO AMPHITHEATRE
NOV. 4-8

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

Before you buy any turning equipment see what you get from SUNDSTRAND

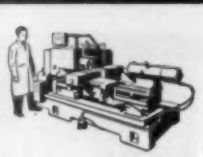
This Sundstrand Automatic Lathe tripled production of aluminum pistons!

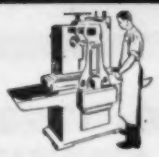
Piston production jumped to 120 per hour, compared with 40 on former equipment, as the result of the change to a Sundstrand Model 8A Automatic Lathe at Wisconsin Motor Corp., Milwaukee. Operations performed include ruffing and finishing the ring grooves, finish turning the outside diameter, facing the piston top, and chamfering the ring grooves — all in a total machining time of just 10 seconds.

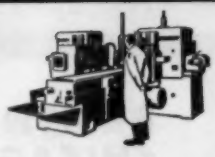
In addition to effecting a sizable boost in production, this Sundstrand automatic lathe eliminates the need for finishing and chamfering the ring grooves in a separate machine, as was formerly required. That's the often told story of Sundstrand turning equipment — high production, reduced handling, and improved accuracy on the broadest possible cross section of parts during short, moderate, and long runs.

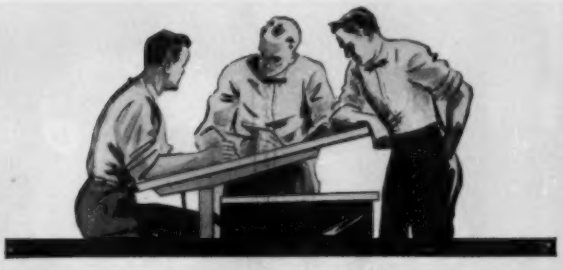
SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS







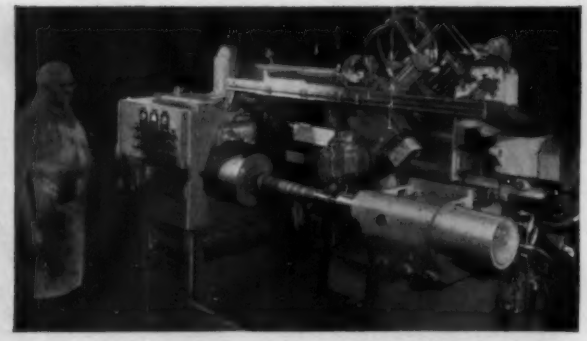


SUNDSTRAND

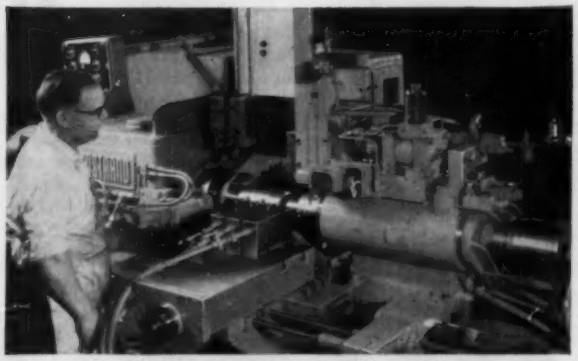
"Engineered Production"

MAKES THE DIFFERENCE

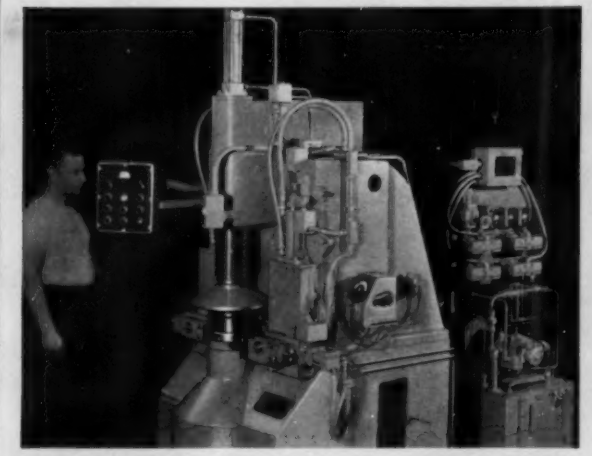
Any turning job is sure to benefit from the application of years of production and design engineering experience to the machine you get from Sundstrand. In addition, you know the choice will be made from the broadest possible range of machines. The machine on the facing page is an example of how a standard automatic lathe can be provided with multiple tooling for long run turning. On this page are vertical, tracer, multiple tool, and special turning lathes that are setting outstanding performance records.



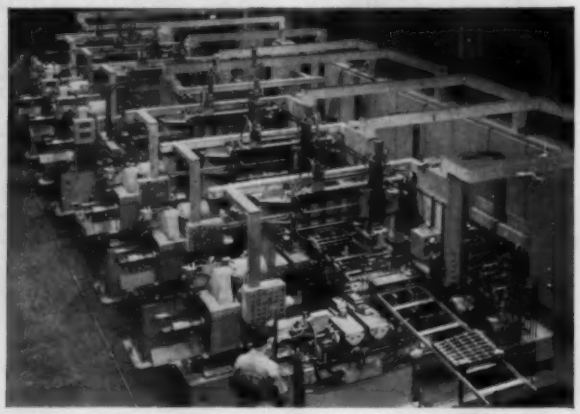
TRACER TURNING—Template controlled slides on Sundstrand tracer lathes permit taking rough, semi-finish, and finish cuts with one turning tool in an automatic cycle. Axle shafts, stem pinions, and similar irregularly shaped parts are typical of those being turned with high efficiency.



MULTIPLE TOOL TURNING—Where a variety of turning, boring, facing, and forming operations are required on a particular part, Sundstrand automatic lathes can be provided with a combination of tools mounted on front, rear, and overhead carriages, permitting the maximum number of surfaces to be machined in a short machine cycle.



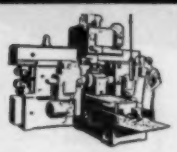
VERTICAL TURNING—This Sundstrand vertical automatic production lathe is basically a standard machine with platens for mounting turning or grooving slides, multiple tool slides, or tracer slides. Floor space requirements are reduced materially, and automatic handling can be applied readily. One operator can readily handle several of these machines.

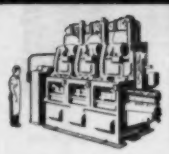


SPECIAL TURNING—Where production requirements are high, Sundstrand special automatic loading process lathe lines, like this one for automotive camshafts, insure high output of top quality work. The part goes through the complete line without any manual handling whatsoever.

More facts about Sundstrand turning equipment are available in Bulletin 184. Write for your copy today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service
FOR BROACHING

It takes all 3

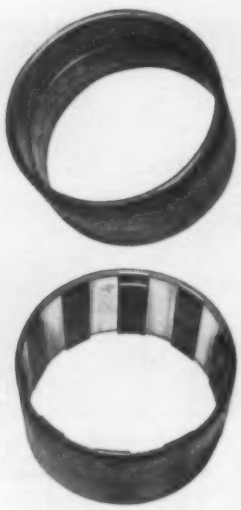
American's "Engineered Production" Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

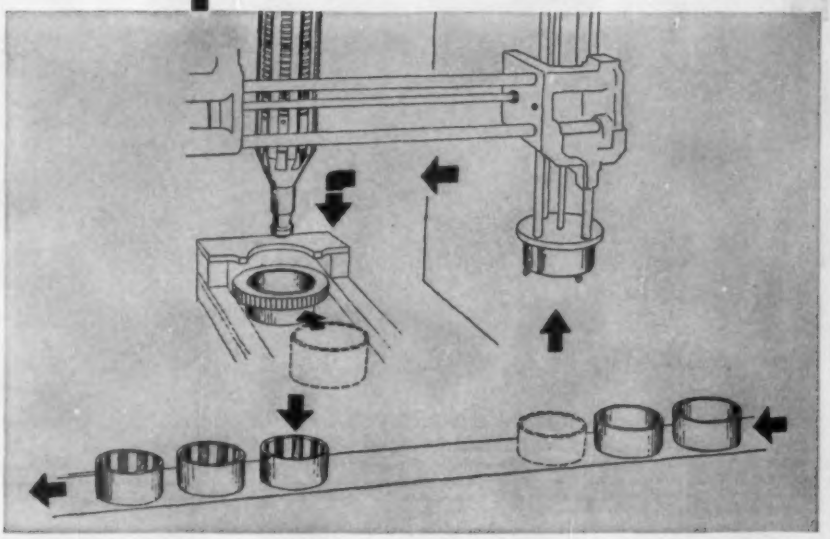
THE JOB—Broaching ten 1.042—1.0435 wide internal splines in an automotive brake drum in a single pass.

THE RESULT—Fully automatic cycle produces 125 parts per hour on vertical hydraulic internal pull-down machine.

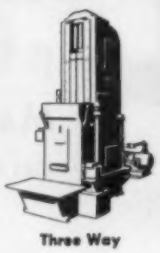
1 PROPER BROACH TOOL DESIGN

Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. For maximum economy on this job, the broach tool is made up of ten sectional surface broach assemblies mounted on an arbor. Maximum user benefit is obtained by easy removal for sharpening and replacement.

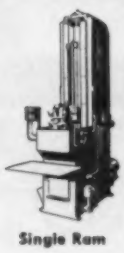




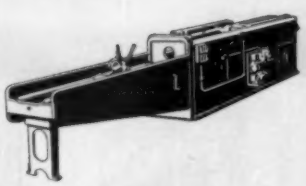
Broaching Tools



Three Way



Single Ram



Horizontal

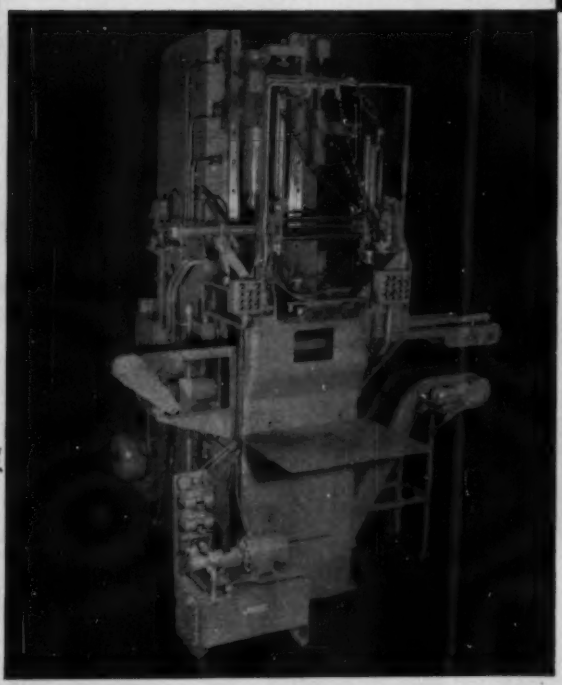
to give you peak broaching performance

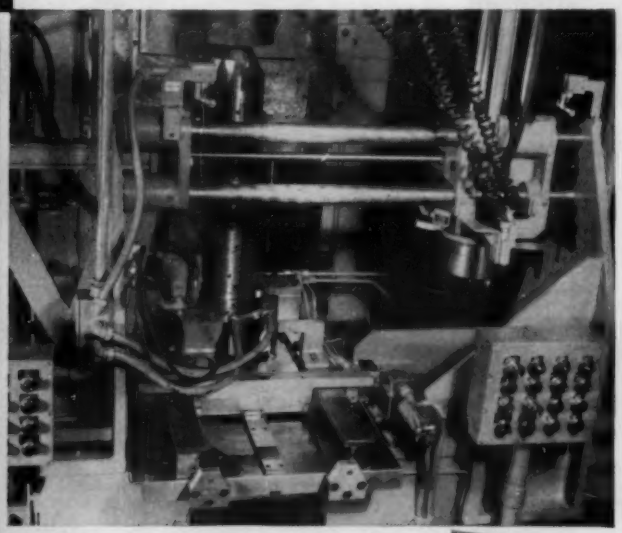
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical hydraulic internal pull-down machine has a full follow-up retriever mechanism and electrical controls. A swinging boom is used for loading and unloading the broach and an automatic chip conveyor unit is provided.

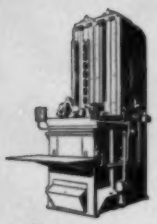
3 EFFICIENT FIXTURING

Whatever your parts geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. In this installation, a hydraulically operated loading mechanism with an internal chuck picks up work from a conveyor and inserts it in a collet-type fixture for broaching. Finished work is automatically ejected to conveyor line. Because "skills" are built into the tool, machine, and fixtures, production schedules are maintained even with inexperienced operators.





More facts are available in American's Pull-Down Bulletin A119. Write for your free copy today.



Duplex Ram

Presses

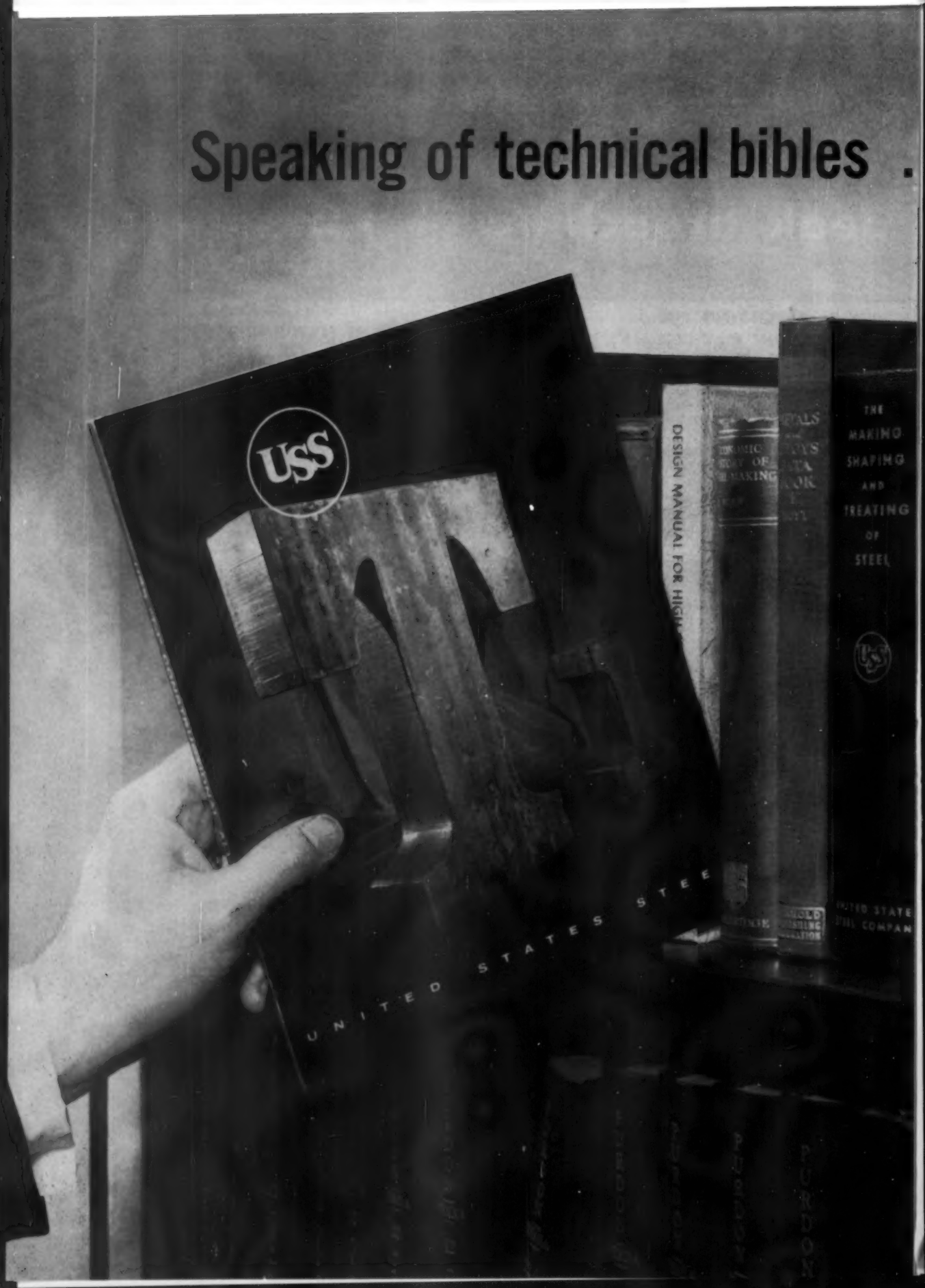
SUNDSTRAND

American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS


Speaking of technical bibles .
USS
UNITED STATES STEEL
DESIGN MANUAL FOR HIGH
THE MAKING SHAPING AND TREATING OF STEEL

here's one that every engineer should have at his fingertips

Without this excellent book,
your technical library isn't complete.
If you haven't already received your free copy,
by all means send for it now.

In it you'll find everything you want to know about USS "T-1" Constructional Alloy Steel—where to use it, when to use it, how to use it; its engineering properties, metallurgical characteristics, fabrication practices, and dozens of interesting illustrated applications.

USS "T-1" Steel is tomorrow's steel available *today*—the remarkable new alloy steel that is drastically influencing design thinking all along the line. Cutting costs, improving products, building them lighter yet stronger—these are the desirable advantages USS "T-1" Steel offers you.

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

"USS" and "T-1" are registered trademarks.

No other steel possesses "T-1" Steel's remarkable combination of high yield strength, toughness and weldability. That's why you can always build it better to last longer with USS "T-1" Steel.

United States Steel Corporation, Pittsburgh
Columbia-Geneva Steel Division, San Francisco
Tennessee Coal & Iron Division, Fairfield, Ala.
United States Steel Supply Division,
Warehouse Distributors, Coast-to-Coast
United States Steel Export Company, New York

RETURN THIS COUPON, NOW!

United States Steel
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Pittsburgh 30, Pennsylvania

Please send a copy of your new booklet, USS "T-1."

NAME AND TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

UNITED STATES STEEL

Stuart CODOL

LIQUID GRINDING COMPOUND

Disc grinder (right) hogs off approximately .035 in. from rough Alnico castings. Small segmented bar-type magnets are ground at a high rate of production on an automatic double-spindle disc grinder. Stuart's Codol helps maintain profitable production . . . covers machine ways and moving parts with a rust-inhibiting film of light petroleum oil.

Continuous grinding is more efficient with Codol as it resists overheating, minimizes wheel loading . . . reduces downtime for sharpening the wheel.

Codol's stability prolongs its effectiveness, reducing cutting oil costs. More than 15,000 gallons of a 3.5 per cent Codol and water solution are circulated from this outdoor reservoir to a battery of grinders in the Spaulding Works of Crucible Steel Company.

How you can use Stuart's CODOL to step up production and reduce costs!

Take advantage of today's improved wheel bonds and more powerful grinding machines by using Stuart's Codol Liquid Grinding Compound . . . a carefully formulated combination of petroleum oil and emulsifier. To give you maximum on-the-job economy, Codol permits faster stock removal, using heavier feeds and harder, larger wheels. For Codol *lubricates* as it cools, prevents metal flow and wheel loading, and eliminates stress failure from heat generated by grinding. On precision work, Codol guards against heat distortion and assures maximum dimensional control . . . especially important when grinding thin-walled parts. Break the heat barrier and upgrade performance on your cylindrical, centerless, and surface grinding operations with Stuart's Codol!

"Rust problems eliminated with Stuart Codol," that's the report from the Spaulding Works of Crucible Steel Company, Harrison, N. J.—makers of widely used Alnico magnets. Experience there on several different grinding machines has proved that Codol's high detergency, lubricity, cooling, and rust-inhibiting characteristics save money by reducing machine wear . . . prolonging wheel life . . . providing good stock removal conditions for rough- and finish-grinding operations.

Since these grinders are serviced from a central reservoir, a highly developed water-mix compound is important for over-all production efficiency at Crucible.

Codol's carefully balanced surface tension floats chips away from the wheel, work, and machine . . . provides a protective film of lubricating oil for machine ways, guide bars, and moving parts . . . gives two-way cooling action that assures efficient grinding at high production rates.

Crucible Steel Co. eliminates rust, reduces machine wear, grinding with Stuart's Codol!

Codol keeps wheel free-cutting on this high-production, single-pass grinding operation, with .0025 in. downfeed per revolution.

Template checks accuracy of convex poles after grinding ends of rough Alnico castings. Codol keeps wheels sharp and free-cutting when "hogging off" stock on the disc grinder.

Phone your
Stuart Service Center

Arrange now to test Stuart's Codol on your difficult grinding jobs.

DETROIT, MICH.	Tyler 7-8500
CHICAGO, ILL.	Bishop 7-7100
HARTFORD, CONN.	Jackson 7-1144
CLEVELAND, OHIO	Prospect 1-7411
PHILADELPHIA, PA.	Devonshire 8-6100
TORONTO, CANADA	Oxford 9-9397

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METALWORKING LUBRICANTS

get this new story on...

ROCKFORD ECONOMY
LATHE

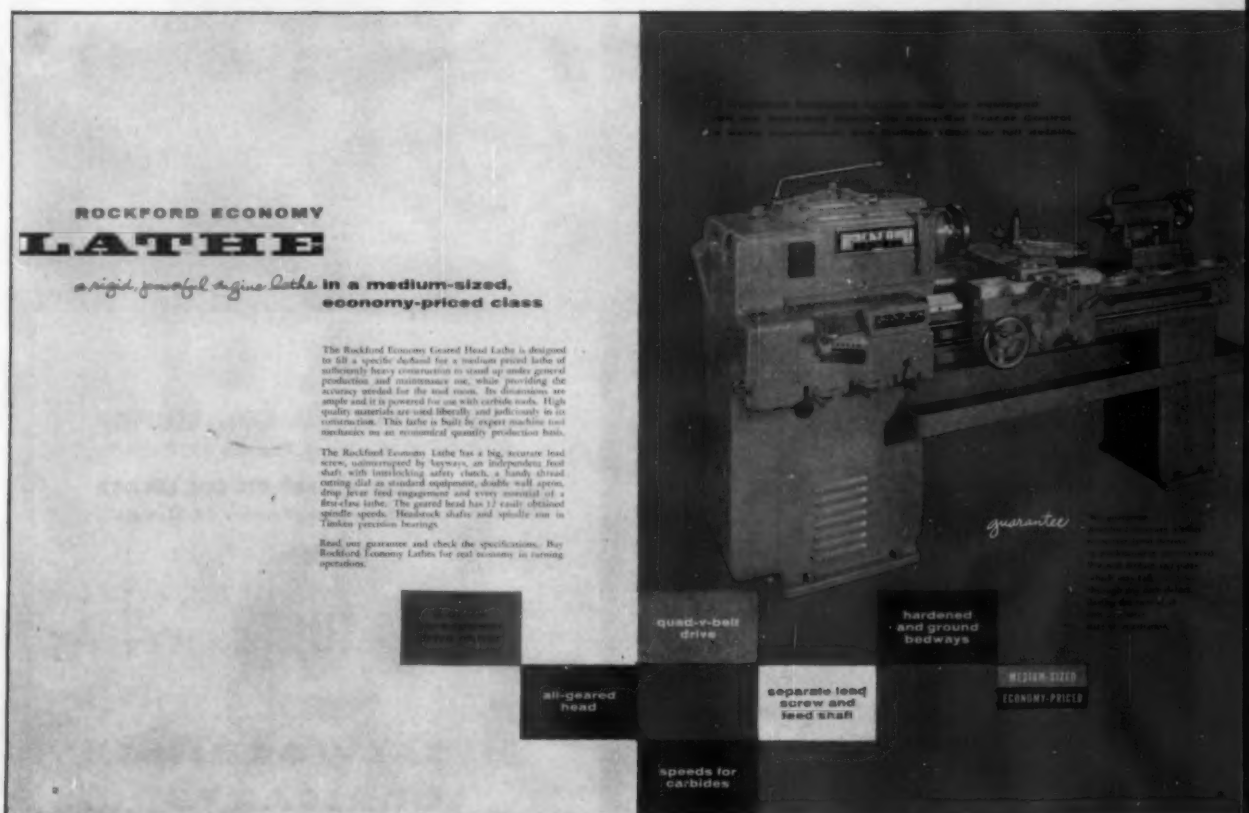
A complete description of this modern, medium-sized, economy-priced lathe designed with . . . .

SPEEDS FOR CARBIDES

RIGIDITY FOR HIGH PRODUCTION

ACCURACY AND FLEXIBILITY FOR TOOLROOM USE

16" AND 18" SWING


ROCKFORD ECONOMY
LATHE
a rigid, powerful engine lathe in a medium-sized, economy-priced class
The Rockford Economy Geared Head Lathe is designed to fill a specific demand for a medium priced lathe of sufficiently heavy construction to stand up under general production and maintenance use, while providing the accuracy needed for the tool room. Its dimensions are ample and it is powered for use with carbide tools. High quality materials are used liberally and judiciously in its construction. This lathe is built by expert machine tool mechanics on an economical quantity production basis.
The Rockford Economy Lathe has a big, accurate lead screw, uninterrupted by keyways, an independent feed shaft with interlocking safety clutch, a handy thread cutting dial as standard equipment, double wall apron, drop lever feed engagement and every essential of a first-class lathe. The geared head has 12 easily obtained spindle speeds. Headstock shafts and spindle run in Timken precision bearings.
Read our guarantee and check the specifications. Buy Rockford Economy Lathes for real economy in turning operations.
guarantee
quad-v-belt drive
hardened and ground bedways
all-geared head
separate lead screw and feed shaft
MEDIUM-SIZED
ECONOMY-PRICED
speeds for carbides

This completely new booklet contains photos, description and drawing of the all-geared headstock with quick-change gear box, standard construction features, and description of spindle, carriage, apron and taper attachment, together with a complete list of specifications and extra equipment.

Every methods and process engineer should have a copy for comparison of production and accuracy lathe values. This bulletin also makes it easily apparent how to specify lathes equipped to meet specific production problems through selection of size, feed and speed range, and electrical equipment. Full description is also available on tracer controlled operation with the Rockford Kopy-Kat Duplicator.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

get a copy - ask your distributor

There's a Rockford Machine Tool Co. representative in your area who will quickly send you a personal copy of this new booklet for reference and file. If you are a methods, process or production engineer, master mechanic or production superintendent drop him a line on your company letterhead, or write us directly for Bulletin No. 904.

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THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

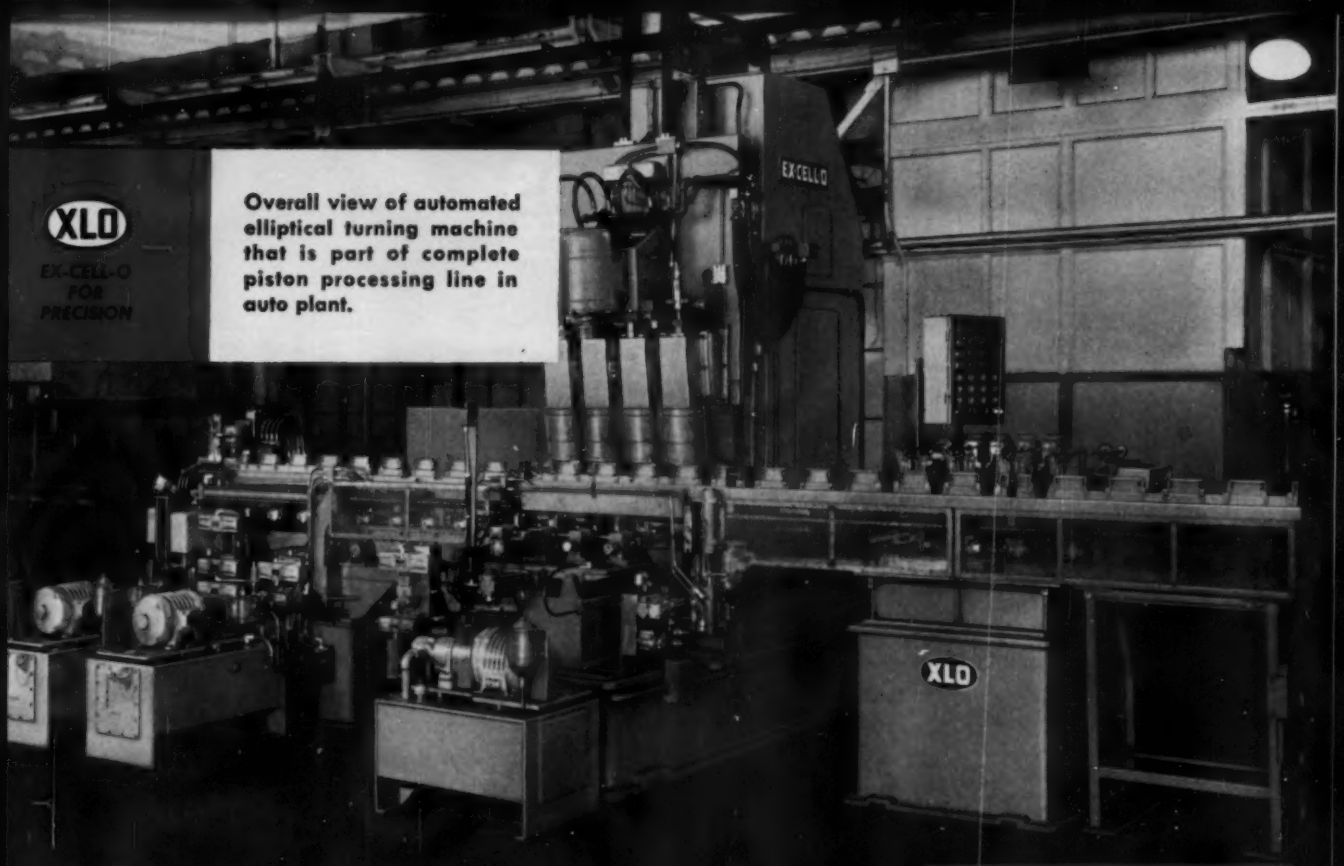
An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock. B-1120

Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

MARVEL Metal Cutting SAWS
Better Machines · Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.



Overall view of automated elliptical turning machine that is part of complete piston processing line in auto plant.

Roughs and Finishes 250 Pistons per Hour

57-77

This automated Ex-Cell-O machine semifinish and finish turns an elliptical shape on automotive piston skirts at the net rate of 250 pieces per hour.

Pistons enter the machine from a conveyor, are radially located from their wrist pin holes and clamped on the ring land diameters. Four heads machine four piston skirts simultaneously. Air gaging follows the machining operation, after which pistons are ejected to another conveyor.

Write to Ex-Cell-O or contact your local representative for further information or a proposal.

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

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INDUSTRIAL DISTRIBUTOR

P D Q

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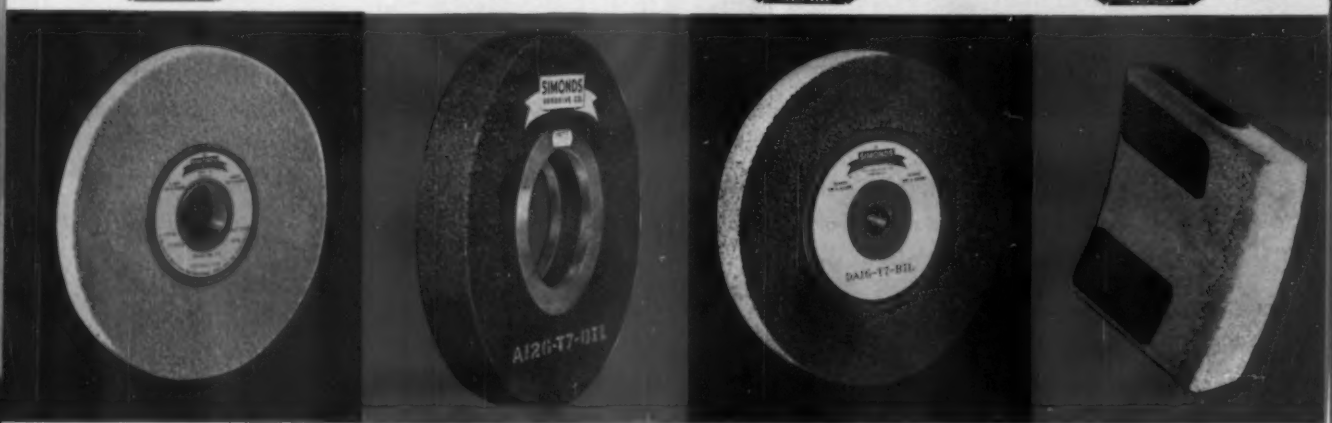
Try these new Simonds products for the most in efficiency

SA Borolon Toolroom Wheels · IL BOND Snagging Wheels · DA Borolon Snagging Wheels · SA Borolon Segments



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MEMORANDUM
FROM ENGINEERING DEPARTMENT
12/12/56
Design Group
Att.: C. L. Smith
Vibrating Conveyor #3 broke down after approximately
17,000,000 cycles of operation. Spring return lever
failed, due to low fatigue resistance. Flexloc locknuts
worn, but still locked in original positions.
Recommendations:
1) Redesign lever to give increased strength in
center section.
2) Eliminate side play in lever motion which has
been causing excessive wear in related parts.
3) Continue use of Flexloc locknuts.
B.F.W.

Why designers specify FLEXLOC self-locking nuts

Where products must be tough . . . must stand up under vibration, shock and abuse . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts as fasteners.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting spring tension in the flexible locking collars. And they are reusable: rough screw threads, repeated removal and replacement, frequent adjustments will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes and materials, to meet the most critical locknut requirements. Your authorized industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL Co., Jenkintown 1, Pa.

We also manufacture precision titanium fasteners. Write for free booklet.

FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

During 1956 the diamonds imported and processed by Norton for industrial purposes were far

From diamond mines...

List Price $25,408 — and well worth it! This Norton diamond wheel, built for a prominent ceramics manufacturer, precision-grinds extremely hard parts. Its ability to last so much longer and grind so much better than other wheels more than justifies its first cost.

For Internal Grinding Norton makes these smallest diamond wheels, together with every other size and type required for surface or cylindrical grinding, sharpening, sawing or cutting-off. And each wheel has the long-lasting excellence that assures the user steady profits.

Replacing Four Separate Grinders, this Norton CM-1 multi-wheel grinding machine enables one operator to grind four diameters simultaneously. Besides freeing three operators for other jobs it reduces capital investment, production time and operating costs. Only Norton offers such long experience in grinding wheels and grinding machines.

Making better products...

greater, in number and in total carat weight, than were available as gem diamonds in the U. S.

Industry's Crown Jewels

The most beautiful and valuable gems ever used for personal adornment are not the only diamonds mined.

Others, known as bort, are vitally important to a wide range of industries. Diamond bort, composed of commercial grade diamonds and of fine-quality diamond fragments, is processed into grinding wheels that grind materials which cannot be ground in any other way.

Norton pioneered in this processing. Leadership in improving every type of grinding wheel as well as abrasives has enabled great advancement in diamond wheel manufacture and performance — including the introduction of major bond types and successfully meeting the grinding problems of new metals, alloys and materials.

As a result — and like the entire line of Norton abrasives, grinding machines, refractories and new electrochemical materials — Norton diamond wheels live up to a reputation for exceptional value.

That is why they are recognized as the *Crown Jewels* of industry for the grinding of carbides, ceramics, stone, glass, electronics and all diamond wheel operations.

NORTON
ABRASIVES

"Hot Rods" Heat Longer and Better. Norton CRYSTOLON* (silicon carbide) heating elements bring many advantages to electric furnace users. Lasting up to three times longer than other nonmetallic elements, "Hot Rods" heat more uniformly and greatly reduce maintenance.

Across the world and still expanding

Abrasive and Grinding Wheel Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy; Brazil.

Behr-Manning Plants — *Coated Abrasives and Behr-cut Tapes* — Troy, N. Y.; Canada; Australia; France; Northern Ireland; Argentina; Brazil.

Electric Furnace Plants — Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec; Brazil.

Grinding and Lapping Machine Plant — Worcester, Mass.

Refractories and Electro-Products Plant — Worcester, Mass.

Norton Pike Plant — *Sharpening Stones* — Littleton, New Hampshire.

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to make your products better

New ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Buy **ARMSTRONG** TOOLS from your Industrial Distributor

Write for catalog

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD**—speeds indexing of inserts.
- **REPLACEABLE SEAT** of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- **SHANK** of Heat Treated Alloy Steel—gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

ARMSTRONG BROS. TOOL CO.

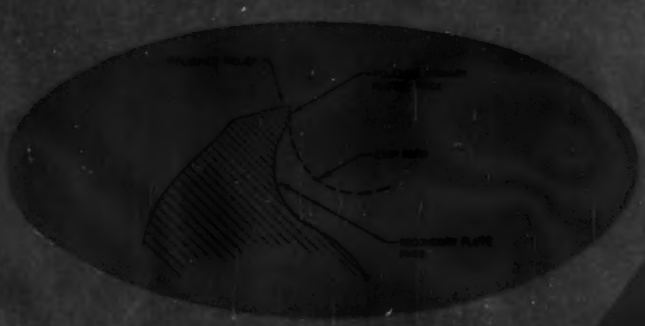
"The Tool Holder People"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

NEW! WELDON *Ski-Kut* END MILLS

FOR CUTTING ALUMINUM

PATENT APPLIED FOR



CUTTING ALUMINUM MADE EASIER, SMOOTHER AND FASTER

The primary flute face of the Ski-Kut End Mills, being narrow, definitely minimizes adherence of chips to the flute faces. Adherence or welding of aluminum chips contributes in a major degree to the difficulty in milling aluminum.

Greater feeds, longer tool life, better finish, easier operation of equipment are some of the advantages to be gained by the use of Weldon Ski-Kut End Mills for cutting aluminum.

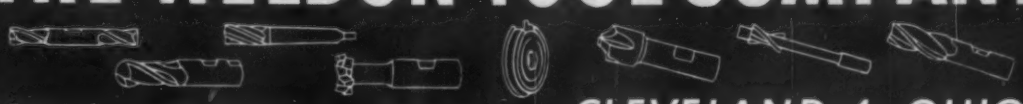
1. Minimizes adherence of Chips to Flute Faces
2. Increased Shearing Action(45° Helix Angle)
3. Hammering Effect Practically Eliminated
4. Greater Feeds
5. Longer Tool Life
6. Better Finish
7. Easier Operation
8. Less Horsepower Required

A RADICALLY NEW DEVELOPMENT IN END MILL DESIGN FOR CUTTING ALUMINUM THAT SPEEDS PRODUCTION AND REDUCES COST.

Weldon SKI-KUT End Mills are available from stock in size from 1/4" to 2" in various lengths. For full information write for folder SKM-1

Weldon Distributors throughout U. S. A. and Canada carry complete stocks to serve you.

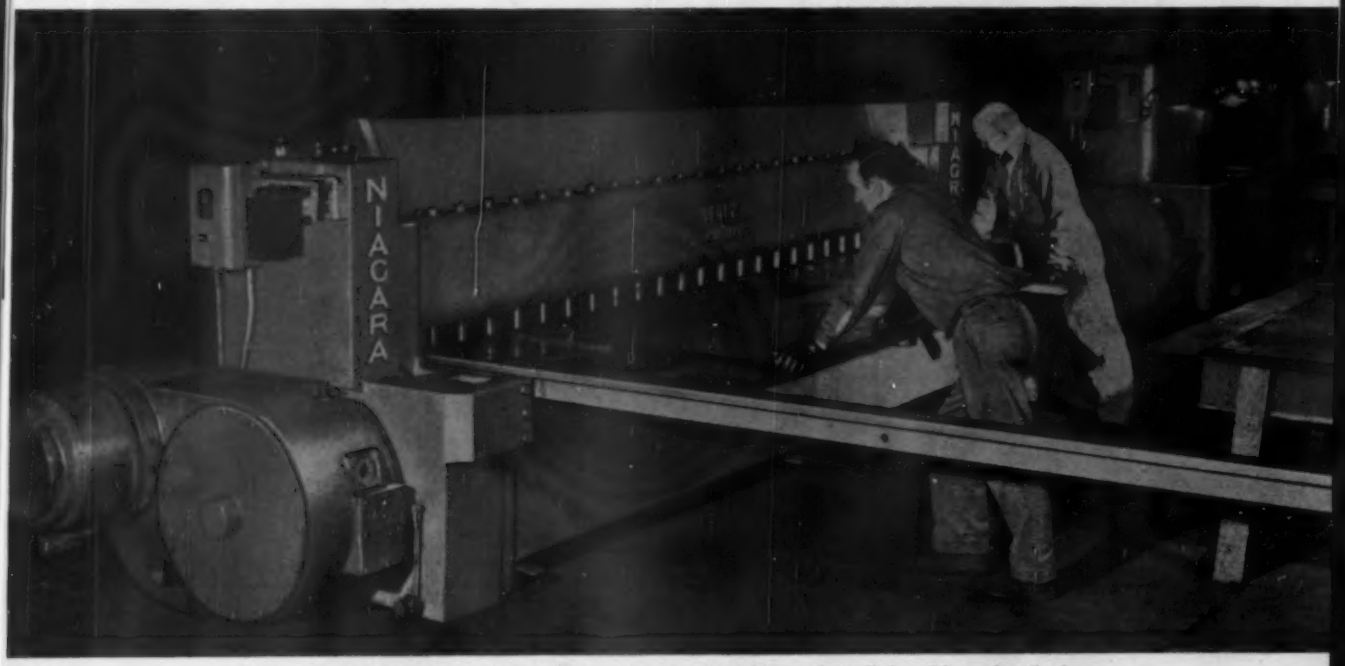
THE WELDON TOOL COMPANY



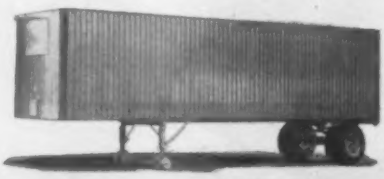
3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

IN POWER SQUARING SHEARS...

Fruehauf picks Niagara for



Niagara Model 912 shearing 18" x 30" transition plates from 10 gage hot-rolled steel for tank trailer frames.



Niagara Model 96 cutting forty 4" x 6" trailer gussets per minute from ⅜" and ½" bar stock.

Niagara Model 812 shearing 11 gage hot-rolled steel to 36" x 144" for trailer floor beams.

Niagara Model 812 at work shearing 24 gage stainless steel to 4' x 6'6" for van trailer door panels. Production: 2.7 pieces sheared all 4 sides per minute.

NIAGARA power squaring shears

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

"exceptional machine value"

World's largest trailer manufacturer spells out its reasons for using Niagara Underdrive Shears in producing a wide variety of parts from cold-rolled and hot-rolled steels, stainless and aluminum

As a metal fabricator, Fruehauf Trailer Company is well-qualified to speak. It not only manufactures every conceivable type of commercial trailer, but "builds more of them than any company in the world."

So, when it comes to power squaring shears, Fruehauf is particularly qualified to speak. Using several Niagara Models, it considers them an "exceptional machine value."

Enlarging on the point, Fruehauf engineers say, "Niagara Shears are capable of holding straight lines within thousandths of an inch . . . they keep their settings . . . trouble-free, they require a minimum of maintenance.

"They're well-balanced . . . can be moved about . . . require no special concrete base. We especially like their minimum height . . . can see over them. It's unlikely that an operator will step out from the shear in the path of a fork lift."

Like Fruehauf, progressive companies everywhere look to Niagara for exceptional machine value in a power squaring shear. Here are a few of the reasons:

TAKE ACCURACY! Niagara's positive, power actuated, self-compensating holddown grips work securely. Fully closed box section construction of bed, crosshead, holddown and housings resists all stresses with minimum deflection.

TAKE SPEED! More working strokes per minute and instant engagement of Niagara's exclusive multi-point sleeve clutch assure more cuts per hour. Full visibility of the cutting line, ease of operation, quick setting gages and safety features boost hourly output.

TAKE MAINTENANCE! Niagara Shears are built to stand the gaff on the toughest jobs. Simplicity of design involving a minimum number of parts, and utmost accessibility cut out costly maintenance.

Any way you look at it, Niagara has the most to offer you in modern shear performance.

NIAGARA'S NEW, FACT-FILLED BULLETIN WILL GIVE YOU THE FULL STORY

'74 Pages — 141 Illustrations . . . Most Comprehensive Shear Bulletin Ever Published . . . 19 Photo Reports of Niagara Shears In Action . . . 44 Revealing Views of Niagara Shear Features . . . Easy-to-read Specs For America's Most Complete Underdrive Line (59 Models, Capacities: 16 gage to 1", Cutting Lengths: 4' to 20')

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see what America's most modern power squaring shears can do for you

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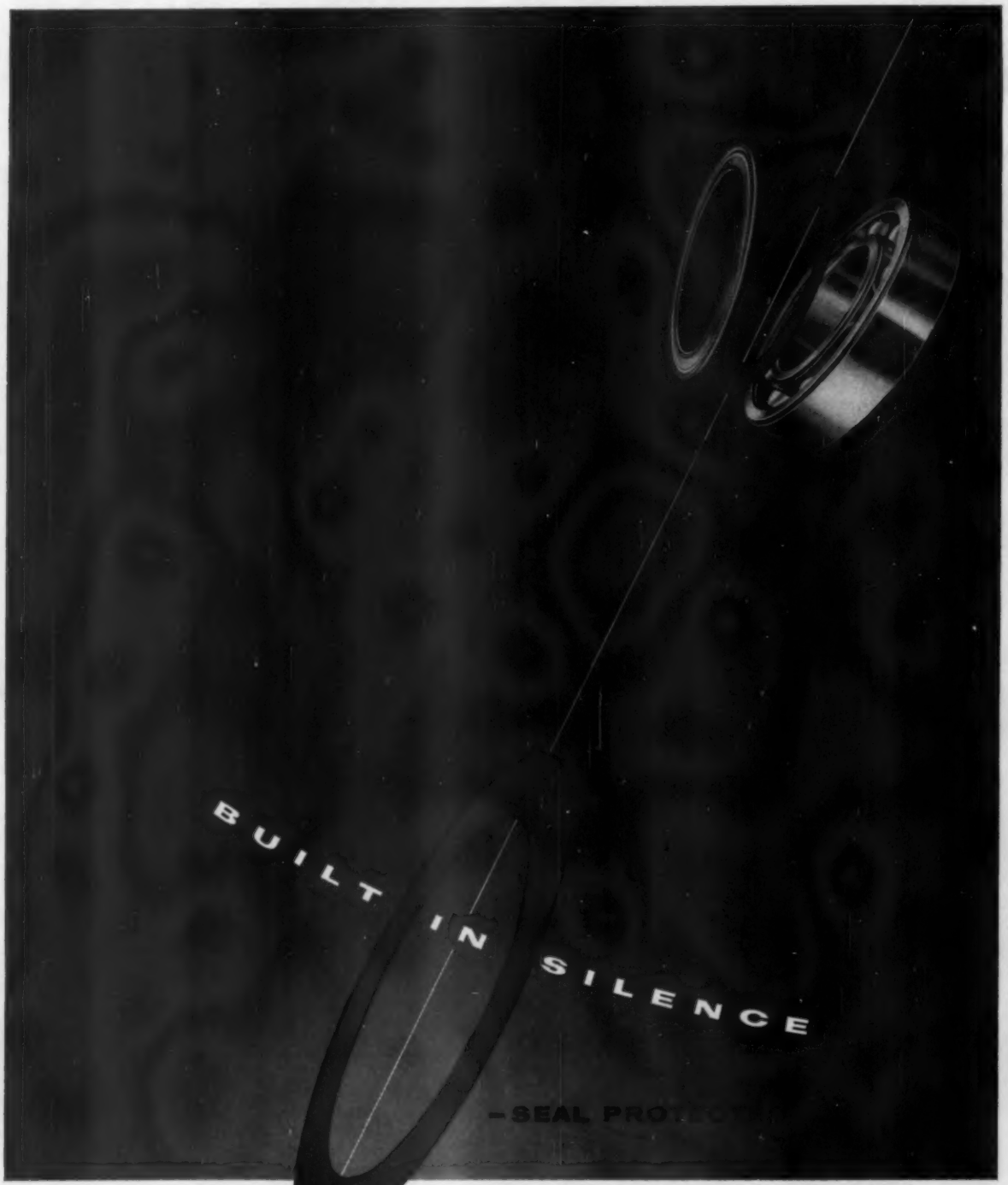

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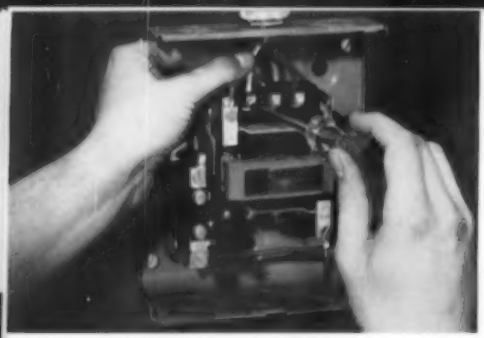
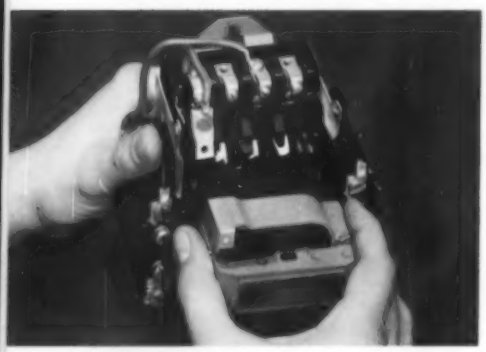
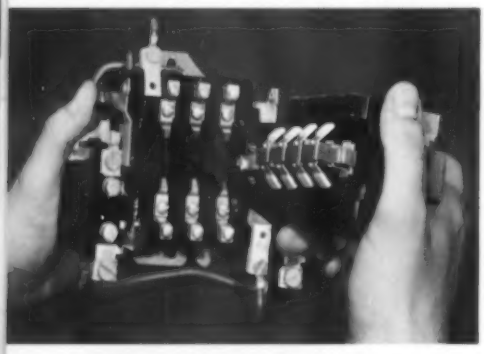


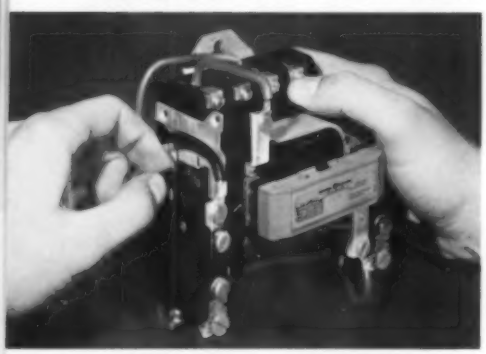
NEW **GREATER WIRING SPACE**
Wrap-around cover—removable enclosure sides make wiring much easier.



NEW **SNAP-SLIDE CONSTRUCTION**
Principal components quickly disassembled for easier inspection and maintenance



NEW **"VERTICAL" CONTACTS**
Continuous dependable operation of new starter—even in dusty atmospheres



NEW **ADJUSTABLE OVERLOADS**
Overload trip setting can be adjusted plus or minus 15% of nominal heater rating.

General Electric announces

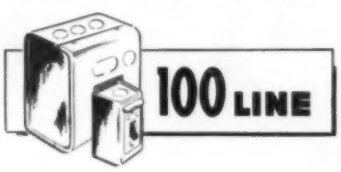
NEW Size 0 and 1 Magnetic Starters—42% Smaller in Size

General Electric now offers a new line of Size 0 and 1 magnetic starters that is 42% smaller than previous open forms and is built to the new NEMA ratings. The new starters with "snap-slide" construction provide easier inspection and maintenance because principal components snap or slide together. Completely new and radically different in design, this line of starters offers:

- wrap-around cover with spring latch—easily removed without tools for inspection
- removable sides for greater accessibility
- straight-through wiring speeds installation
- pressure-type terminals make wiring easy
- vertically-slanted contacts give higher tip pressure, reduce possibility of contact welding
- long life "kick-off" spring provides clean break of contacts in any mounting position
- strongbox coil with Mylar* insulated start wire for longer coil life
- overload relays adjustable for ±15% of trip setting
- nine field modification kits for greater flexibility
- new maximum NEMA ratings up to 7½ hp at 220 volts and 10 hp at 440 volts

Two additional features of the new magnetic starter are extremely quiet operation and lower inrush requirements of the coil. Sound absorbing material around the magnet lowers the operating noise level. Lower coil inrush current will allow you to use a 47% lower rated control transformer with this starter—saving you money and mounting space.

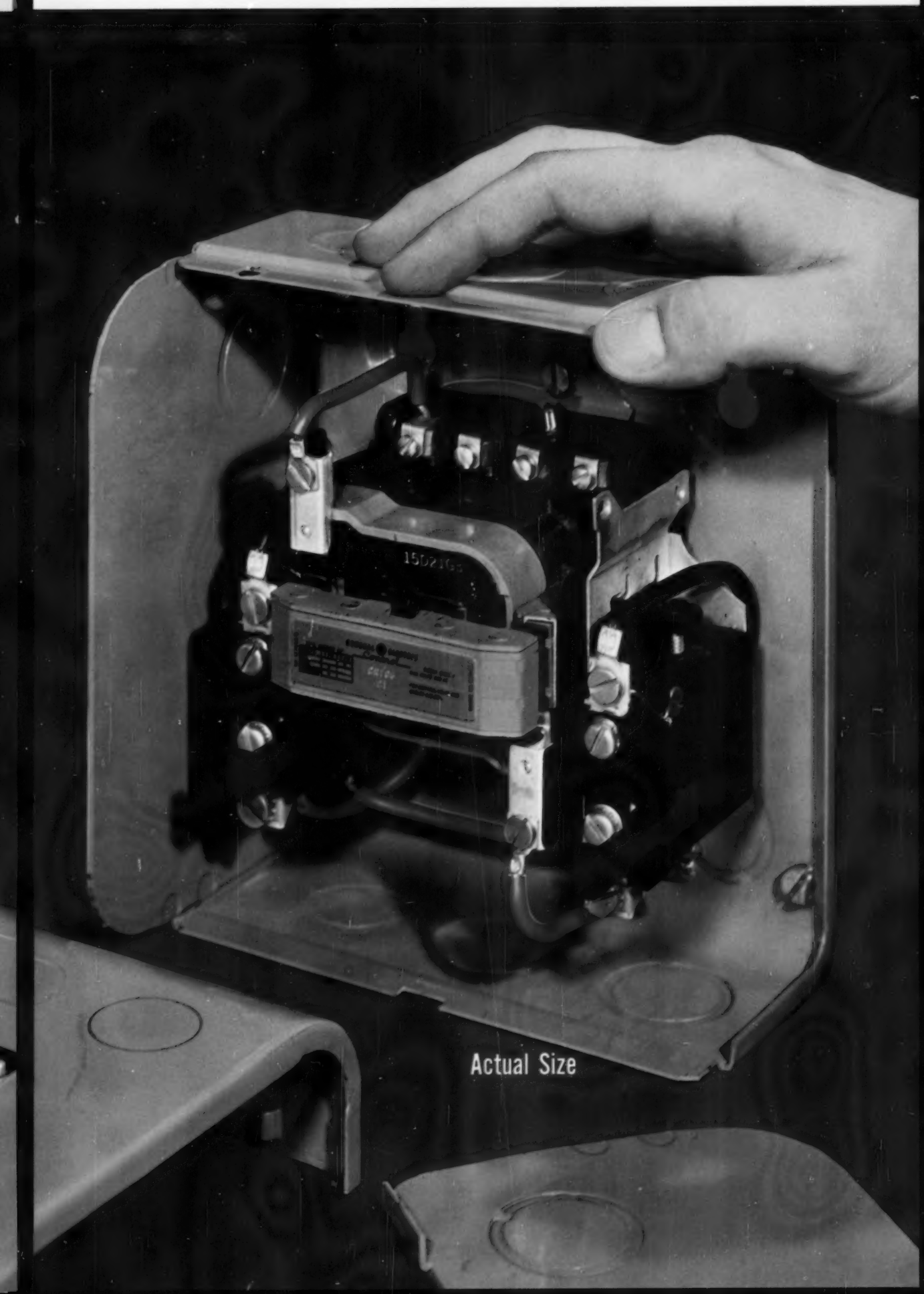
Size 0 and 1 General Electric starters are available now in non-reversing, combination, reversing and multispeed forms. Contact your nearest General Electric Sales Office or Distributor, or write Advertising Section 731-13 for the 20-page bulletin describing the line. Ask for GEA-6611. General Electric Company, Bloomington, Illinois.



*Trade-mark of DuPont Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC



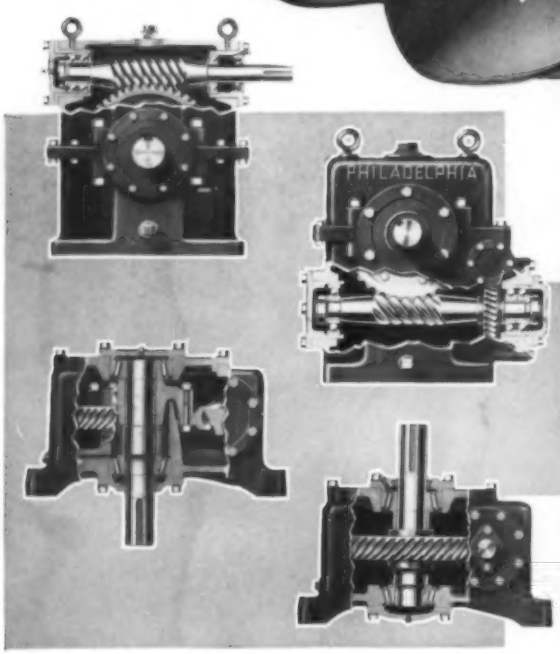
Actual Size

Here's where Worm Reducer Efficiency Begins

Because the service life and efficient operation of any Worm Gear Reducer depends upon the precise meshing of the worm and gear, we make every possible effort to assure that they are properly centered when the unit is assembled, and that the alignment will be permanent . . . Worms are of finest quality alloy steel with case hardened threads—shaft and threads being smoothly ground and polished after hardening. Worm gears for smaller size units are of solid chill cast nickel-bronze to meet AGMA specifications; while for larger size units the gear is made in two parts—the rim of chill cast nickel-bronze, bolted with fitted bolts and locknuts onto a semi-steel center.

The engineering skill and knowledge put into these features alone are indicative of their entire construction.

Scientific design, unexcelled workmanship, finest materials, rugged construction, noiseless and vibrationless operation, long-life and highest efficiency—are the "end results" that have earned an enviable reputation for Philadelphia Worm Reducers.



PHILADELPHIA WORM GEAR REDUCERS

A complete range of unit types and sizes to cover applications from ¼ to 265 H.P. Ratios from 3⅝ to 1, to 6300 to 1. Our latest Catalog, WG-156, gives complete details . . . When requesting Catalog, please use your business letterhead.

phillie gear®

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

Get into the BLACK with SIMONDS Rotary FILES and get longer tool life

Simonds gives these hardened High Speed Steel Rotary Files an *extra-special* terminal hardening and tempering which pays off to you with a sharp increase in wear-resistance. This final operation gives these files their distinctive *black* color.

And this black color now becomes the "market-mark" of the longest-lasting, fastest-cutting files of this type.

Furnished in Hand Cut or Ground-from-Solid types in a full range of standard shapes and sizes. Special shapes made to order. When dull, we can re-sharpen these files by re-grinding and repeating the terminal hardening process.

Try these easy-to-recognize, longer-lasting Simonds Rotary Files and get *more* for your file dollars.

Look for the Simonds name on the black shank.

125 YEARS OF GROWTH • 1832-1957

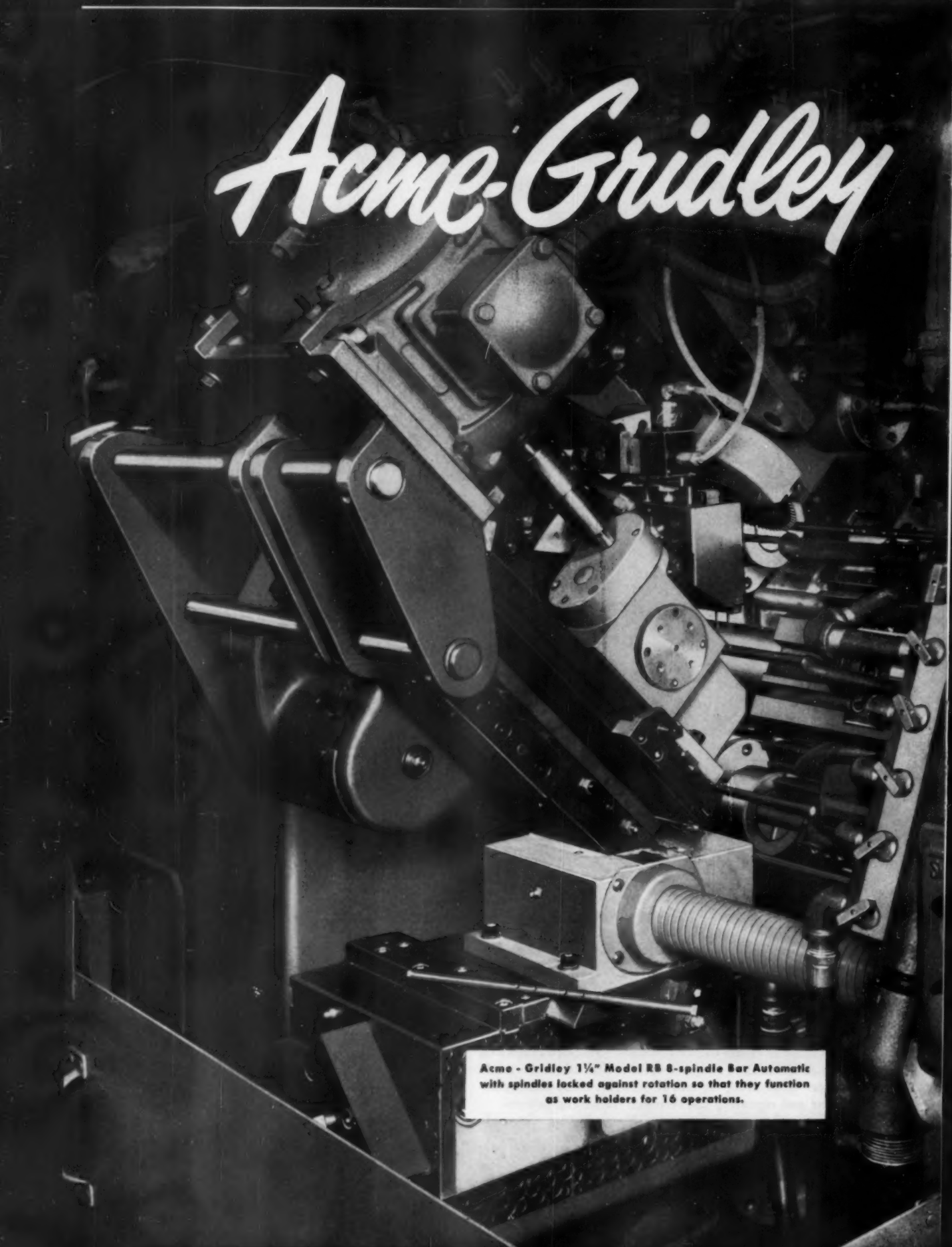
SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

For Fast Service from Complete Stocks

Call your
SIMONDS Industrial Supply DISTRIBUTOR

Acme-Gridley

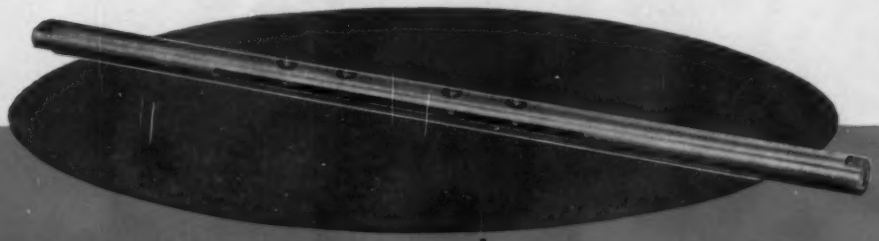


Acme - Gridley 1¼" Model RB 8-spindle Bar Automatic with spindles locked against rotation so that they function as work holders for 16 operations.

basic design + proper tooling

. . . reduces machine investment 75%

. . . reduces cost-per-piece 90%



This customer wanted to determine the quickest and most economical way to make double-barrel carburetor shafts. NAMCO engineers recommended a procedure that resulted in his producing these shafts at one-tenth the previous unit cost and on a machine that required but one-fourth the equipment investment needed to accomplish the job by in-line manufacturing methods.

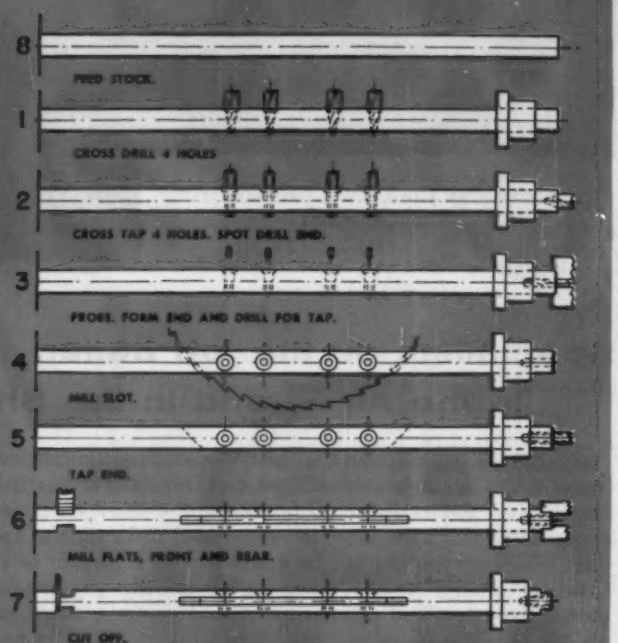
Selected to do the job was a standard 1¼" RB 8-spindle Acme-Gridley bar automatic. Each of its eight spindles was locked against rotation so that it functioned as a work holder as the machine indexed the work from position to position. Because accurate indexing is one of the inherent features of Acme-Gridley basic design, it assured proper alignment of the work with the standard and special attachments on the end and side toolslides. This permitted holding the close tolerances required on the part while performing the 16 operations indicated on the tooling diagram shown at the right.

★ ★ ★

WRITE FOR YOUR FREE COPY OF TP-44. It shows how maximum production versatility and cost reduction can be realized in your manufacturing operations.

JOB FACTS

PART.....Carburetor Shaft **MACHINE TIME**....6.7 Seconds
MATERIAL.....Brass **GROSS PRODUCTION** 533 per hr.
NUMBER OF OPERATIONS.....16



why don't you

INDEX . . . to lower machining costs . . .

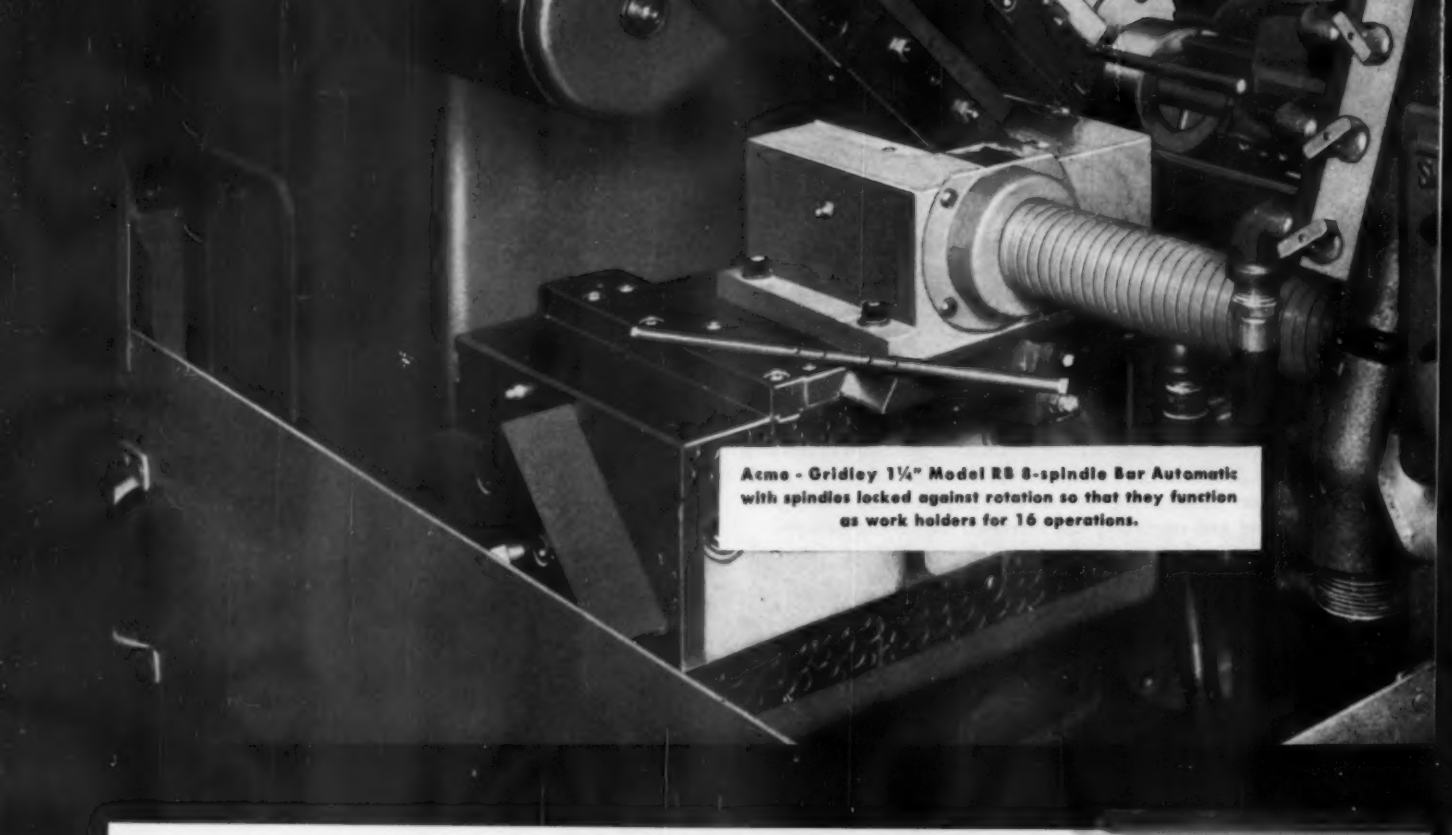
with *Acme-Gridley*

CONTROLLED CYCLE

National Acme

THE NATIONAL ACME CO.
171 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices . . . Newark, N. J. . . . Detroit, Mich. . . . Chicago, Ill.



Acme - Gridley 1¼" Model RS 8-spindle Bar Automatic with spindles locked against rotation so that they function as work holders for 16 operations.

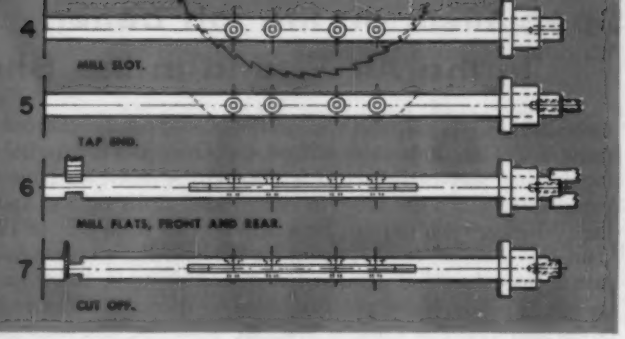
Capt. Ormond M. Gove, TWA Jetstream pilot, has logged over 4 million miles.

Specialists do the job better:

basic design, it assured proper alignment of the work with the standard and special attachments on the end and side toolslides. This permitted holding the close tolerances required on the part while performing the 16 operations indicated on the tooling diagram shown at the right.

★ ★ ★

WRITE FOR YOUR FREE COPY OF TP-44. It shows how maximum production versatility and cost reduction can be realized in your manufacturing operations.



why don't you

INDEX . . . to lower machining costs...

with *Acme-Gridley* **CONTROLLED CYCLE**

National Acme

THE NATIONAL ACME CO.
171 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices . . . Newark, N. J. . . . Detroit, Mich. . . . Chicago, Ill.

THE OLD GRIND GOT

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels

Capt. Ormond M. Gove, TWA Jetstream pilot, has logged over 4 million miles.

Specialists do the job better:

In the Air . . . and in the Shop, too

Since 1934, TWA Captain Ormond M. Gove has specialized in safe flight. Since 1916, Carlton has specialized, too. Our specialty: radial drill research, engineering and manufacturing. Our entire energies have been concentrated to produce the most modern radial drills on the market – nothing else. Whatever you require, be it arm lengths from 3-ft. to 12-ft. or column diameters from 9" to 26", count on Carlton. For programming, pre-select, partial pre-select and manual speed-feed controls, count on Carlton. And for added productivity, you can count on special Carlton engineered bases, tables and jigs. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

SPECIALISTS IN RADIAL DRILLS

THE OLD GRIND GOT YOUR GOAT?

Butt definitely, a good way to meet grinding-wheel problems is . . . head-on. Take your goat by the horn and switch to CINCINNATI (PD)° WHEELS.

They offer Positive Duplication—a remarkable achievement in precision manufacturing and quality control that can save you money . . . and increase your production.

You don't need a long gray beard to wise up to (PD) WHEELS. Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel every time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels.

Grinding problems will never again get your goat, if you see your Cincinnati Grinding Wheels Distributor. He'll be glad to explain how (PD) WHEELS can save you money and increase production. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—only CINCINNATI Grinding wheels give you

(PD) POSITIVE DUPLICATION

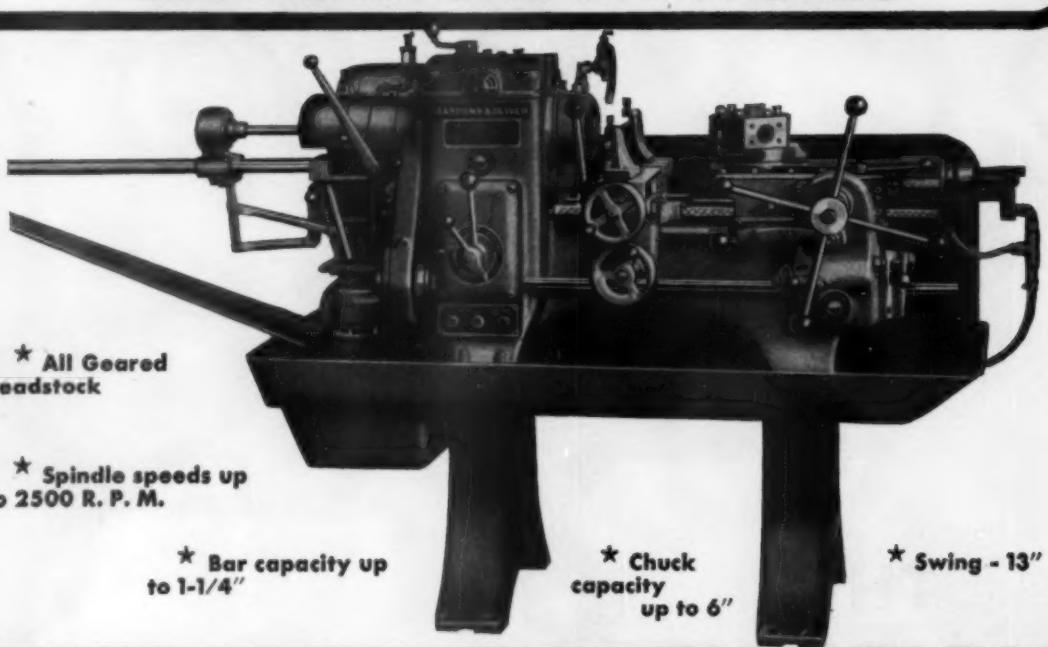
CINCINNATI° *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Trade Mark Reg. U.S. Pat. Off.

The BARDONS & OLIVER No. 2 GEARED ELECTRIC

Turret Lathe Handles *BOTH* BAR and CHUCK WORK



★ All Geared Headstock

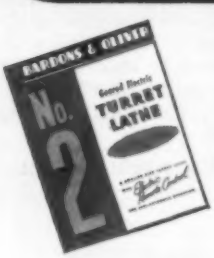
★ Spindle speeds up to 2500 R. P. M.

★ Bar capacity up to 1-1/4"

★ Chuck capacity up to 6"

★ Swing - 13"

Why buy two Machines ... When ONE will do the Job?.. Check these *Outstanding Features*



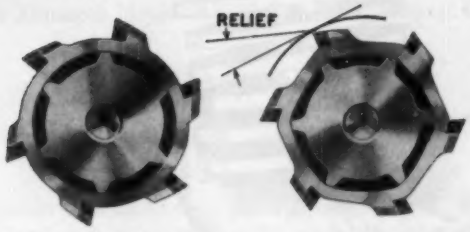
Write For New Catalog On Your Company Letterhead

- Only tenths of a second for spindle reversing and two to one speed changing.
- Permissible spindle reversals up to 10 cycles per minute.
- Twelve unduplicated quick speed changes in several optional ranges.
- Instantaneous Dynamic spindle brake.
- Headstock redesigned to deliver 25% more power.
- Automatic spindle reverse and speed change actuated by the operating cycle of the hexagon turret (optional extra).
- Redesigned heavy duty turret slide and saddle for greater accuracy, longer life, and quicker indexing.

Manufacturers of a complete line of Turret Lathes and Cutting-off Lathes

BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO



Bending of the tool body in expansion automatically provides clearance.

With Each Expansion, You Get A New Cutting Edge

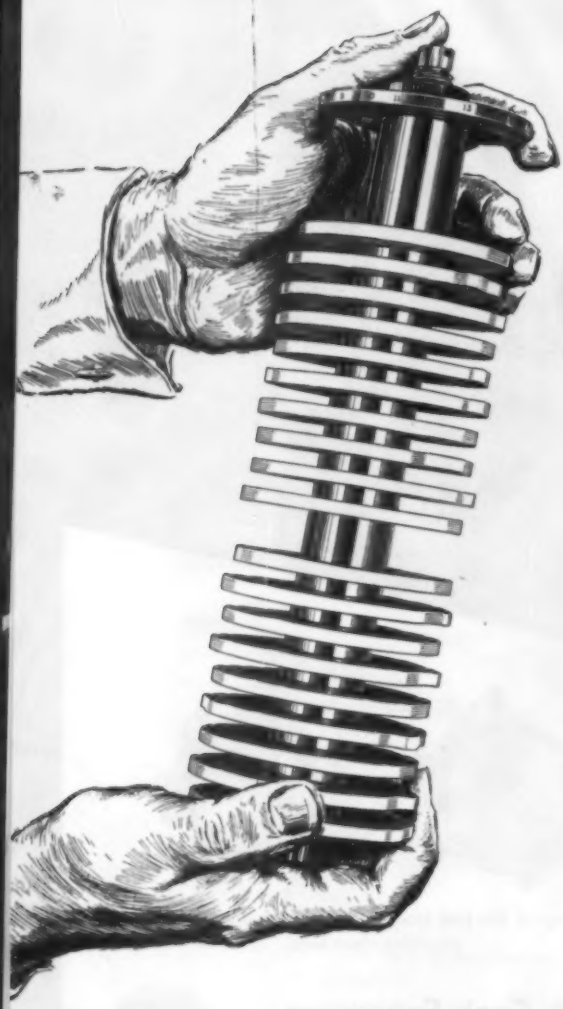
There's extra rigidity and accuracy in these Staples Expansion Reamers. Tool bodies are solid—not split. Expansion plugs, contacting well beyond the rear of the tips, apply uniform parallel pressure.

. . . Write for a catalog of Staples Precision Carbide Tools.

Staples
CARBIDE TOOLS

THE Staples TOOL COMPANY

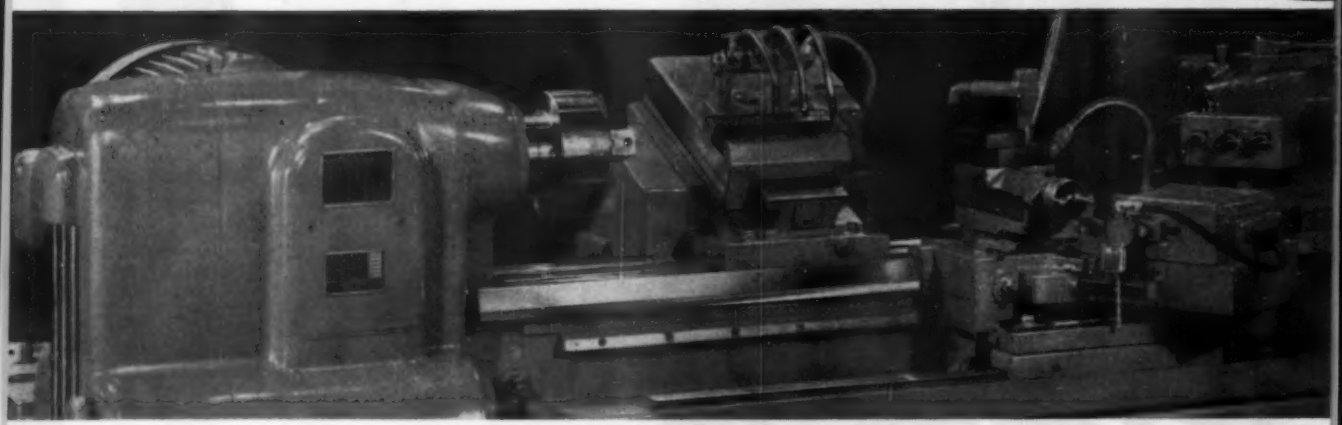
2352 Glendale—Milford Road, Evendale, Cincinnati 15, Ohio



He's holding

Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle lathe available today.

You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.



Flexibility Unlimited

Drive motor may be single speed or two speed. Or inbuilt *constant surface cutting speed* may be provided. This often increases production 30 to 40% on shaft turning, even more on facing cuts and forgings. . . . You can get a *two-position tool holder;* one position for a roughing cut, the other for a finishing cut. Indexing is automatic as a part of the cycle. Think what this means in increased production and better tool life . . . Might chip disposal be a problem? Then a *power chip conveyor* is for you. It removes chips from the machine automatically . . . Keep chips and coolant under control with a *chip and coolant guard* that functions at will of operator or automatically at proper time during cycle.

an automatic cycle

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to take advantage of the economies inherent in ceramic tooling.

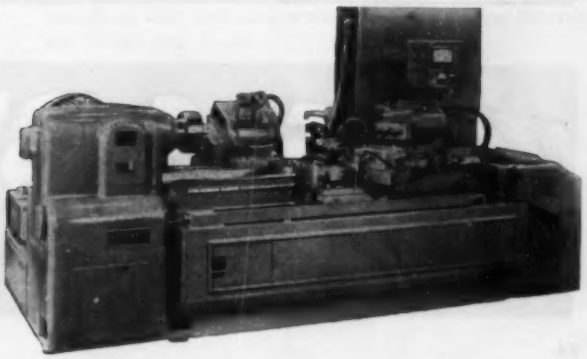
This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing the multi-cycle programmer and making a few quick readjustments at the front of the machine.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known, so fast in operation that the only cycle speed limitation is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail. **The Monarch Machine Tool Company, Sidney, Ohio.**

The above statement that the Model 21 is loaded with production features is not an idle one. Here are some of them.

- Automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle. This is a Monarch exclusive.
- All feeds adjustable under cut. Such flexibility is desirable on some work where it lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control. This accounts for a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within ± .001" on most jobs.
- All way surfaces flame hardened and ground. Included are bed ways, "Air-Gage Tracer" slide and rear slide way surfaces. The accuracy built in is retained year after year.
- Work piece change speeded by a single lever on tailstock. This is a multiple position lever which in proper sequence controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.



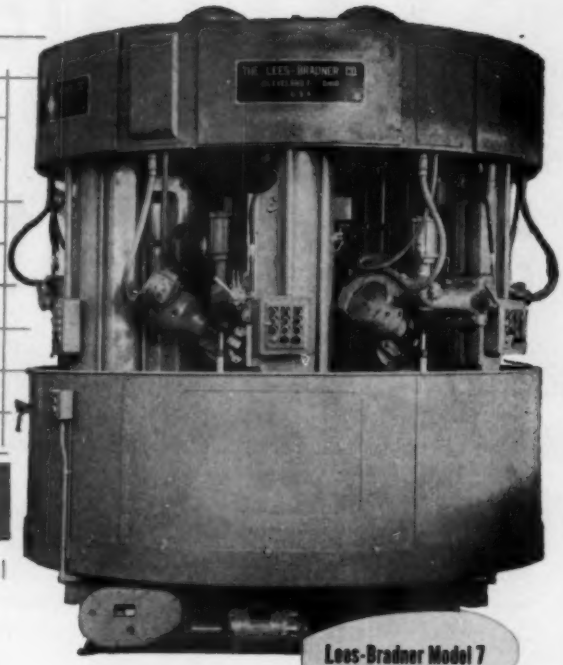
Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE

FOR A BETTER TURN FASTER . . . TURN TO MONARCH

LEES-BRADNER

Sets the HOBBING pace for tomorrow

with 6 machines in 1



Lees-Bradner Model 7 HD 8" x 20" 6-Spindle Rotary Hobber. Also available in single and 4-spindle models.

Here's a complete hobbing production line in one space-saving unit. Actually the Lees-Bradner Model 7, HD 6-Spindle Hobber is six separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H. P. motor.

This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slow-down. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 6-spindle rotary hobber. Write or wire us direct for his name and address in your area.

View of new HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

8-Spindle 7-A Rotary Hobbers also available.

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

all-new 32-speed geared-head lathe

Here are the all-new Hendey No. 2013 and No. 2516 lathes, with an all-geared, 32-speed headstock, complete line-up of toolroom features, and heavy-duty design combined with toolroom precision. The greatly simplified mechanical design gives you more machine, dollar for dollar, than any other lathe in the same class.

32 spindle speeds: You quickly and easily select the speeds (from 18 to 2000 rpm) through two selector dials. Crowned, flame-hardened spur gears simplify design and reduce maintenance. You get maximum power for production work.

66 feed and thread changes: Quick-change spur gears, mounted on involute splines, are selected through two dials. Quick-change threads per inch range from 2 to 120. Feed range is from .0015 in. to .091 in. per revolution. There's an automatic overload release for the carriage feed. Load meter on the headstock tells the operator when he is taking full advantage of available power.

Toolmaker features: This lathe has them all: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 threads, from 2 to 120 per inch, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to half nuts.

New two-speed tailstock: Compare these features with costlier lathes on the market: Weighing almost 400 lb, the tailstock still can be positioned quickly and easily with one hand. Ways under it are hardened and ground. Large 4½ in. diameter spindle has full 10 in. extension, with slow and rapid traverse speeds.

Automatic spindle adjuster: Spindle bearings never need adjusting regardless of operating speed you select. Three sets of super-precision tapered roller bearings support the spindle at both ends and in the middle, increasing accuracy and improving finish.

Hendey **machine division**
BARBER-COLMAN COMPANY
101 Loomis St., Rockford, Illinois

BARBER COLMAN ®

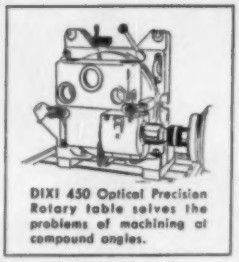
DIXI 60
horizontal optical jig borer

The ONLY Horizontal Jig Borer Built Today! Combines the ACCURACY of the Vertical Spindle With the VERSATILITY of the Horizontal Spindle

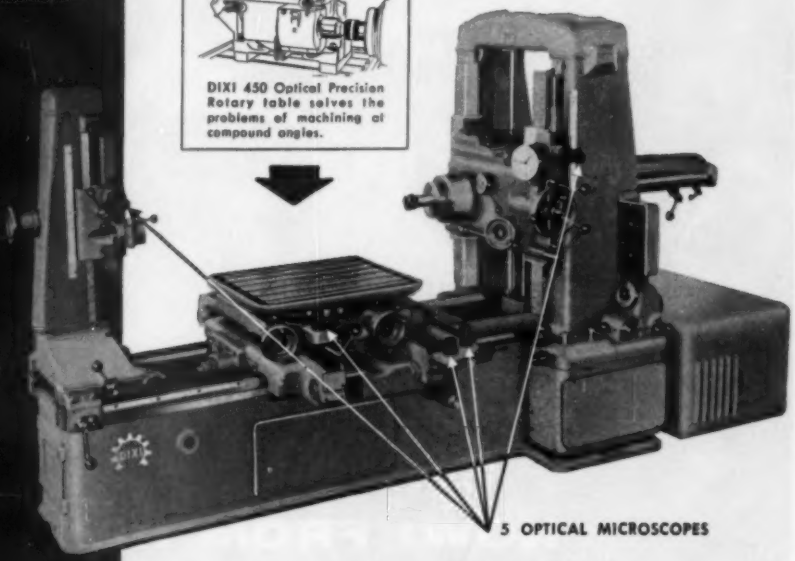
ACCURATE:
Optical settings provide an overall accuracy of .0002.

VERSATILE:
Optical settings for operations in all planes and compound angles . . . equally suitable for tooling, short-run or production work . . . permits JIGLESS boring, facing, milling and drilling.

PRODUCTIVE:
Saves time, labor & costs . . . Unclamping, positioning, fine adjustment, reclamping and rechecking can be made in less than 10 seconds.



DIXI 450 Optical Precision Rotary table solves the problems of machining at compound angles.



5 OPTICAL MICROSCOPES

The DIXI Optical Reversing Process assures perfect alignment as well as round, taper-free holes. In work pieces with line bores on opposite sides, this is obtained by optically indexing the built-in rotary table 180°, locking the spindle feed and using the hydraulic table in-feed instead. Electrical infinitely variable speed spindle drive; infinitely variable hydraulic feeds; special features eliminate effect of spindle over hang on accuracy.

Made in Switzerland — All measurements in inches

- Guaranteed service by factory trained staff
- Engineering staff available for consultation
- Spare Parts in New York stock
- Your operators trained

DIXI 60 now in wide use in leading aircraft and manufacturing plants throughout the United States.

THIS VERSATILE MACHINE IN OPERATION at our New York, and other conveniently located Demonstration Centers.

Our Headquarters in New York City

MBI

M. B. I.
export & import ltd.

A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, New York

"Over 25 years experience in designing & building machinery"

DIXI 60 IN OPERATION AT BOOTH #316
National Metal Exposition & Congress
INTERNATIONAL AMPHITHEATRE—CHICAGO
NOVEMBER 4 TO 8, 1957

CUSTOM-CUT SHAPES—Another reason why it pays to buy from **U. S. STEEL SUPPLY!**

U. S. Steel Supply's flame-cutting service

reduces handling and machining costs

THE PICTURE ABOVE shows an ultramodern automatic flame-cutting machine *pre-shaping to exact specifications* an order of plate steel for a U. S. Steel Supply customer. And saving him plenty . . . by reducing his handling and machining costs . . . and by improving both the *quantity* and the *quality* of his output.

You'll find the latest custom-cutting equipment, including costly flame-cutting machines, in all of our 18 warehouses. By using our facilities, you eliminate the need for installing and maintaining equipment of this type in your plant . . . and thereby materially reduce your capital investment in shop equipment.

If you would like to know about the time-and-money-saving advantages of buying your steel from U. S. Steel Supply, we suggest that you contact our nearest warehouse.

U. S. STEEL SUPPLY
DIVISION

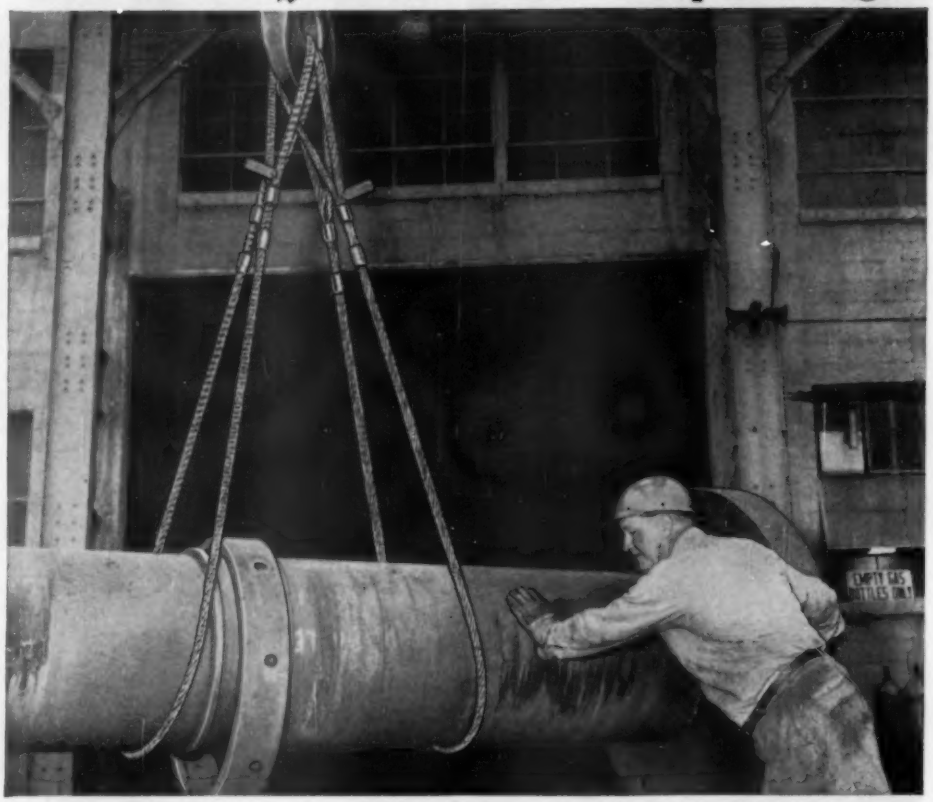
P. O. Box 1099, Chicago 90, Ill.

General Offices:
208 So. La Salle Street, Chicago 4, Ill.

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

ACCO Registered® Wire Rope Slings



Lifting a finished part calls for safe, proved slings!

• Certainly, you didn't use inferior machine tools, material or labor to produce that finished part! Then, don't risk the chance of it suddenly becoming scrap loss due to the failure of a homemade, unproved sling! Too often, riggers are called upon to perform all-important lifts with makeshift slings of questionable quality—a "false economy" that can prove to be both costly and dangerous. Your rigger is a skilled employee —deserving of the same high quality tools to do his job as any other skilled workman.

To make certain that your rigger has the right tools to lift any load with a full margin of safety, see that he is equipped with the only sling made with the same painstaking accuracy as a precision-made tool—ACCO *Registered* Wire Rope Slings. Each ACCO *Registered* sling is factory proof-tested at twice its rated load carrying capacity. Only then does it receive an ACCO tag and registration certificate.

In addition, only these slings give you the assurance of DUALOC endings...the double-locked mechanical ending which guarantees full wire rope strength with either thimble or plain loop.

Don't delay...call your nearest ACCO distributor today and let him work out the details of how to give your production line "registered" protection with ACCO *Registered* wire rope slings.

Free Sling Information • Write our Wilkes-Barre office for your copy of new **Folder DH-532,** which gives strengths and weights (for six different lifts) on a full size range of ACCO *Registered* Cable-Laid Slings.

WHAT "ACCO REGISTERED" MEANS

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification tag on each sling
6. Signed Registry Certificate with each sling

ACCO

AMERICAN CHAIN & CABLE COMPANY, INC., WILKES-BARRE, PA.

Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

In Canada: Dominion Chain Company, Ltd., Niagara Falls, Ontario

ACCO for Better Values

SPEEDY SLING SERVICE with ENGINEERED SAFETY!

ACCOLOY® KUPLEX SLING CHAINS

Quick Service from Distributor's Stock!

• Your nearby ACCO Authorized Sling Chain Distributor now offers a new sling service that saves time and money for you. This is made possible by American Chain's sensational, newly-designed **ACCOLOY KUPLEX Sling Chains.**

SAFE, STRONG, STREAMLINED

These slings are the *latest and greatest development* in sling chains. All parts in each leg are manufactured *exclusively* by American Chain, of the same alloy, and engineered to be as strong as the chain itself. They are of a streamlined design that reduces the possibility of catching or snagging.

Finally the component parts are factory proof-tested to twice the working load limits—your assurance of maximum strength and safety.

Another valuable feature: all parts remain visible for easy, periodic wear inspection.

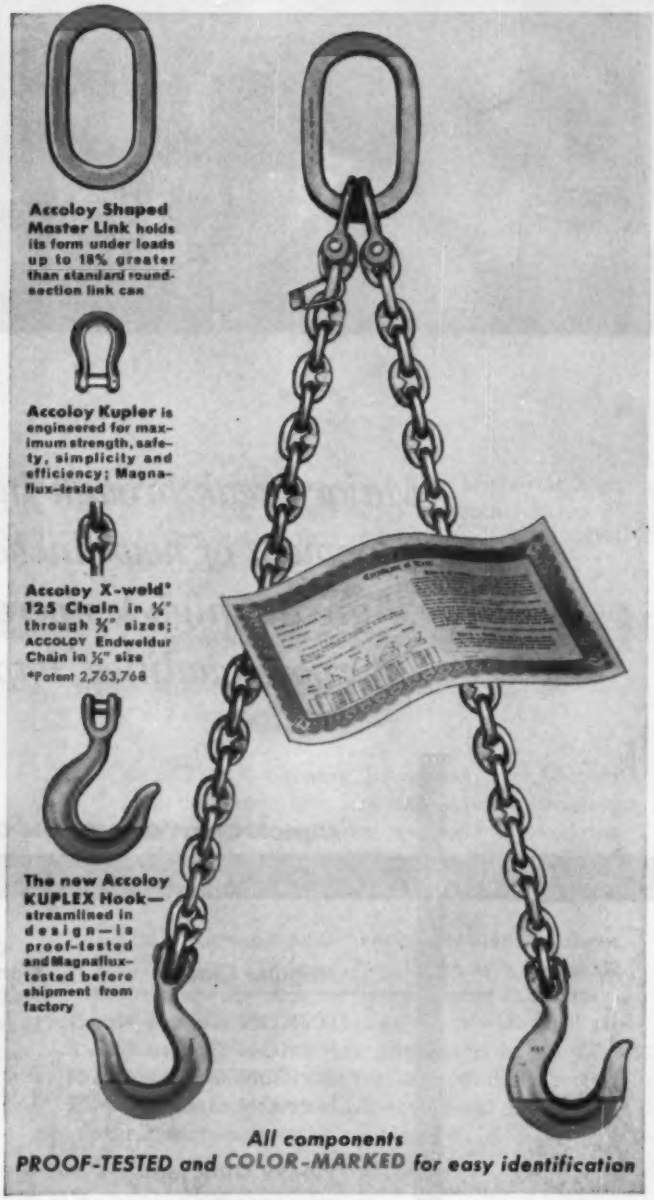
TWO STYLES—SIX SIZES

The new ACCOLOY KUPLEX Sling Chains are available in single-leg and two-leg styles and in six chain sizes, from ¼" through ⅞". All chain is made of Accoloy 125 material. All component parts of each assembly are marked and easily identified as to the size of chain with which they are to be used. Components are *color-marked in* orange for easy identification.

CERTIFICATE OF TEST, issued by ACCO and signed by your Authorized Distributor, is furnished with each sling shipment.

GET THE COMPLETE STORY

You will find it to your advantage to learn the full story of ACCOLOY KUPLEX Sling Chains—how easy they are to assemble and disassemble . . . how promptly and easily they can be serviced . . . and how you can benefit from this Great New Distributor Service and this Great New Sling Chain. Write for **Folder DH-54** and name of nearest ACCO Authorized Sling Chain Distributor.



Accoloy Shaped Master Link holds its form under loads up to 18% greater than standard round-section link can

Accoloy Kuplex is engineered for maximum strength, safety, simplicity and efficiency; Magnaflux-tested

Accoloy X-weld* **125 Chain** in ¼" through ⅝" sizes; **ACCOLOY Endweldur Chain** in ⅞" size

*Patent 2,763,768

The new Accoloy KUPLEX Hook—streamlined in design—is proof-tested and Magnaflux-tested before shipment from factory

All components
PROOF-TESTED and COLOR-MARKED for easy identification

American Chain Division
AMERICAN CHAIN & CABLE
Bridgeport, Conn. • Factories: *York and *Braddock, Pa.

ACCO

Sales Offices: *Atlanta, Boston, *Chicago, *Denver, Detroit, *Houston, *Los Angeles, New York, Philadelphia, Pittsburgh, *Portland, Ore., *San Francisco

*Indicates Warehouse Stocks

A new line

RYK

Major breakthrough in grease technology results in development of new thickening agent. New grease has greater high temperature stability, superior multi-purpose qualities, improved lubricating properties.

Check Chart Of RYKON Greases

Regular Line	Grade Consistency
RYKON Grease No. 0....	0
RYKON Grease No. 1....	1
RYKON Grease No. 2....	2
RYKON Grease No. 3....	3
Heavy Duty Line	
RYKON Grease No. 0 E.P.	0
RYKON Grease No. 1 E.P.	1
RYKON Grease No. 2 E.P.	2

STANDARD

STANDARD OIL COMPANY (Indiana)

of Standard Oil greases

KON GREASE

Standard Oil instituted a grease research and development project several years ago. The result of this work is the line of RYKON Greases, which contain a new non-soap, organic thickener.

RYKON Greases surpass in stability and performance the best greases made up to this time. They bring to industry new opportunities for improved machine performance. They greatly reduce maintenance and grease handling problems.

RYKON Grease Properties

RYKON Greases are smooth, buttery-textured greases, made from the finest quality, solvent-extracted oil. Their thickening agent is a Standard Oil exclusive. RYKON Greases have these high-quality characteristics:

High temperature stability —Better heat stability than any other petroleum oil grease. ASTM dropping point of 480°F. Maintain consistency in service at high temperatures.

Mechanically stable —Maintain consistency even under severe mechanical working.

Chemically stable —Inhibit oxidation. Oil and thickening agent in combination possess extremely good chemical stability.

Oil separation —Minimum bleeding of oil in service and storage.

Wide temperature range —Lubricate at high and low temperatures. Extended range of application thus obtained makes RYKON Greases truly multi-purpose.

Water resistance — Do not lose consistency in presence of water. Resists water washout.

Anti-rusting —Exceptional natural rust preventive characteristics.

With RYKON Greases, lubrication can become simple, foolproof and less expensive—much less expensive, perhaps, than a single shut down caused by equipment failure due to the use of the wrong grease or the use of an "economy" grease.

RYKON Greases come in four Regular and three Heavy-Duty grades. Thus there is a RYKON Grease to take care of every grease lubrication job. Using RYKON Greases plant-wide can reduce your grease storage requirements, simplify lubrication maintenance training, cut down record keeping, save on dispensing equipment and reduce investment in grease inventories.

Get more facts about RYKON Greases. Call your nearby Standard Oil industrial lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

INCREASE PROFIT MARGIN ON FORMED STAMPINGS WITH U. S. MULTI-SLIDES®

Reduce your costs and increase your profit potential! Elimination of secondary operations and handlings results in reduced costs. It is therefore important to produce parts, wherever possible, complete in one machine. The U. S. Multi-Slide, through a combination of built-in motions, allows for the designing of tools to fabricate precision formed metal stampings without secondary handlings.

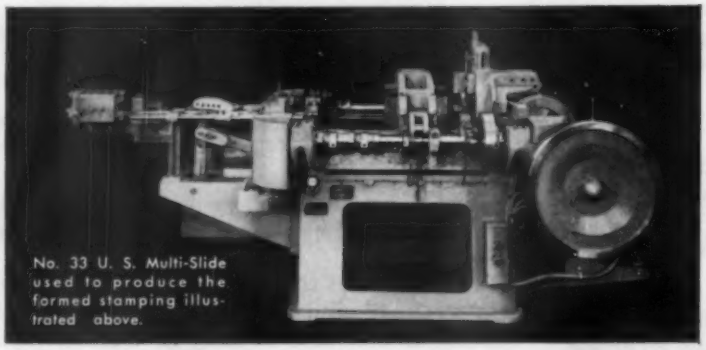
Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position, and a vertical movement for stripping and transferring. Since these movements are part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves. The machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously, as illustrated in the sequence of operations drawing below.

Investigate. Ask for a copy of our Bulletin 15-AP, or send us part drawings or samples for our recommendations.

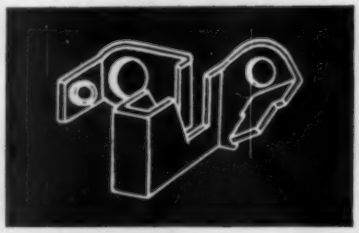
U. S. TOOL COMPANY, INC.

Ampere (East Orange) **New Jersey**

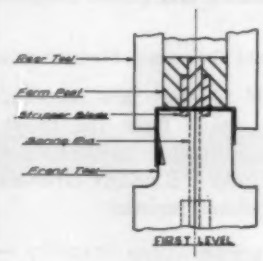
Builders of U. S. Multi-Slides — U. S. Multi-Millers — U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

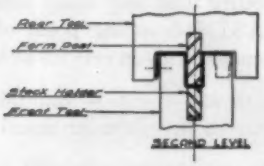


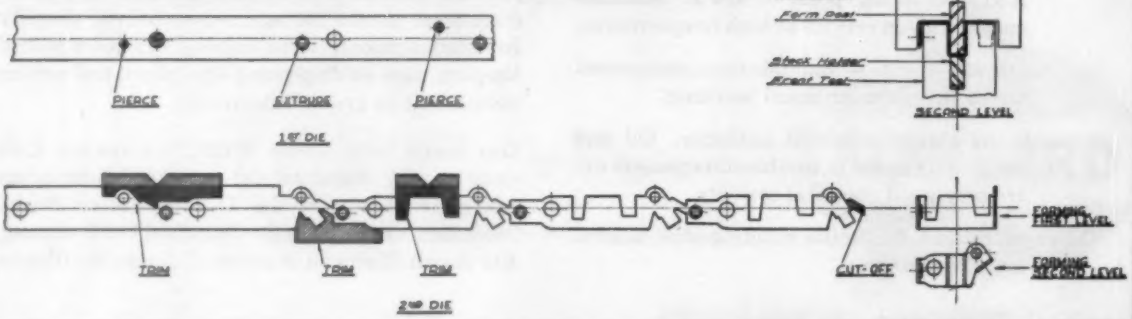
No. 33 U. S. Multi-Slide used to produce the formed stamping illustrated above.



The automotive component shown above is produced complete, without secondary operations, in the No. 33 U. S. Multi-Slide Machine. Drawings below indicate the sequence of stages in the dies and forming positions. Observe the two-level forming position used to complete the piece after cutting off.







5 sure ways

to cut production costs

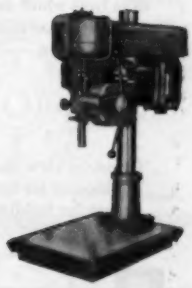
with WALKER-TURNER

"LIGHT-HEAVYWEIGHT"

MACHINE TOOLS

Combining rugged construction, large capacity and unusual versatility, Walker-Turner "Light-Heavyweights" are ideal for a wide range of precision tooling and heavy-duty production operations. Frequently they can be used to replace or supplement larger, expensive machines *and do a better, more economical job*. They can be moved quickly and easily from job to job, yet retain the accuracy and sturdiness of permanently-installed equipment.

Ask your distributor to show you how Walker-Turner tools can make your plant more productive with low initial investment. He's listed under "Tools" in your telephone directory.

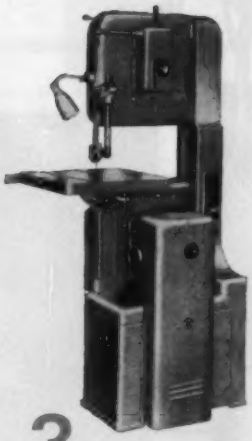


1. USE WALKER-TURNER DRILL PRESSES

These "Light-Heavyweight" 20" and 15" drill presses can't be equalled for fast, accurate production drilling. Available in bench, floor and production models—single or multiple spindle.

2. USE NEW WALKER-TURNER RADIAL DRILLS

They give you all the operating features of larger machine tools costing several times as much. Made in 24 models with 4¼" or 6" spindle travel. Nothing on the market touches these new radial drills in price or dollar value.



3. USE WALKER-TURNER BAND SAWS

With its variable speed drive, the W-T 16" band saw can be adjusted instantly, while machine is running, to correct cutting speed for any metal—even tool steel. 14" models also available.

4. USE WALKER-TURNER GRINDERS

Designed to handle your most exacting grinding operations. Complete line includes 7" tool grinder (illustrated), 6" bench grinder, surface grinder, and 6" carbide tool grinder. Portable dust collector also available.

5. USE WALKER-TURNER CUT-OFF MACHINES

This W-T cuts fast, true and clean—frequently eliminates finishing operations. Can be used with abrasive cutting wheels or saw blades for fast cutting-off of metals, plastics or wood.

Mail coupon for details on the complete Walker-Turner line!

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Pittsburgh 8, Pa.

☐ Please send name of my W-T distributor.
☐ Please send literature.

Name_____
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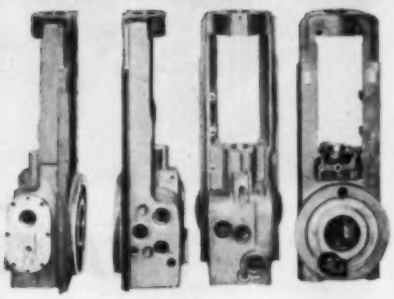
Tool slides precision with BURGMASTER

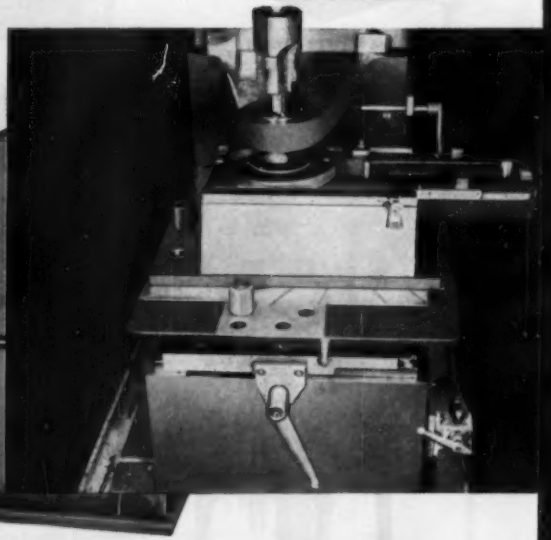
TWO MODELS AVAILABLE

2BH—6 spindle—¾" capacity
3BH—8 spindle—1½" capacity



Tool slides showing all four sides from which precision machining operations are performed.

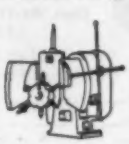
Close-up view showing pin locator air locked fixture for holding tool slide in first set-up. Other fixtures are similar.



Specialists in High Production Turret Drilling

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity



2BF Flange Mounted Power Index ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2PT-3PT Automatic Tape Controlled ¾" and 1½" Capacity

machined 5 times faster

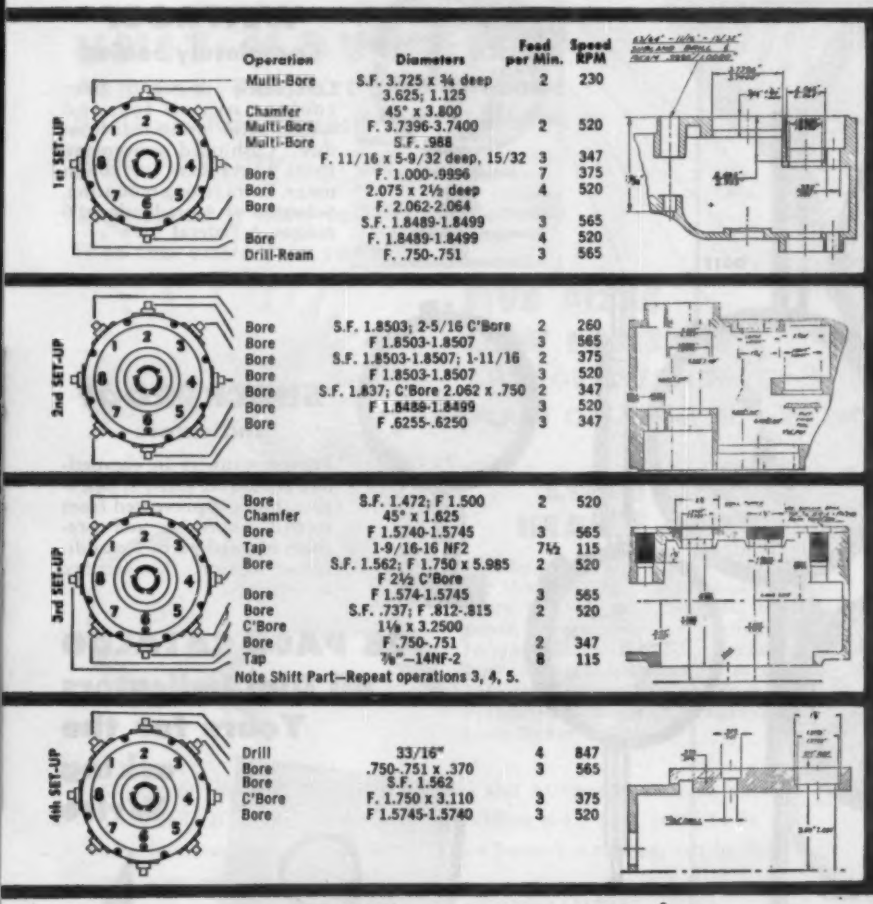
AUTOMATIC HYDRAULIC 8-SPINDLE TURRET DRILL

(1½" CAPACITY)

Burgmaster Automatic Hydraulic Turret Drills are designed to give both precision and speed. On machine slides, 26 operations on 14 centers are now machined in 2.5 hours average, which formerly required 12.5 hours on a horizontal boring mill—a saving of 80%. These operations include drilling, boring, reaming, spotfacing, and tapping, with bores held to .0004" tolerance and centers to .001". **Although the machine is used for many other jobs, this one alone repaid its cost in 1½ years.**

Automatic hydraulic machine operation is the answer which provides power indexing to the eight-spindle turret, pre-selects spindle speeds, provides infinitely variable pre-selective feeds, rapid approach and return, and accurate depth control. All operations are carried out at their most efficient rate for high finish, precision, accuracy, speed, and longest tool life.

Burgmaster engineers are prepared to suggest similar savings on your work. There is a Burg direct representative or dealer near you—consult them freely—there is no obligation.



	Operation	Diameters	Feed per Min.	Speed RPM
1st SET-UP	Multi-Bore	S.F. 3.725 x ¾ deep 3.625; 1.125	2	230
	Chamfer	45° x 3.800		
	Multi-Bore	F. 3.7396-3.7400	2	520
	Multi-Bore	S.F. .988 F. 11/16 x 5-9/32 deep, 15/32	3	347
	Bore	F. 1.000-.9996	7	375
	Bore	2.075 x 2½ deep	4	520
	Bore	F. 2.062-2.064 S.F. 1.8489-1.8499	3	565
	Bore	F. 1.8489-1.8499	4	520
	Drill-Ream	F. .750-.751	3	565
2nd SET-UP	Bore	S.F. 1.8503; 2-5/16 C'Bore	2	260
	Bore	F 1.8503-1.8507	3	565
	Bore	S.F. 1.8503-1.8507; 1-11/16	2	375
	Bore	F 1.8503-1.8507	3	520
	Bore	S.F. 1.837; C'Bore 2.062 x .750	2	347
	Bore	F 1.8489-1.8499	3	520
	Bore	F .6255-.6250	3	347
3rd SET-UP	Bore	S.F. 1.472; F 1.500	2	520
	Chamfer	45° x 1.625		
	Bore	F 1.5740-1.5745	3	565
	Tap	1-9/16-16 NF2	7½	115
	Bore	S.F. 1.562; F 1.750 x 5.985 F 2½ C'Bore	2	520
	Bore	F 1.574-1.5745	3	565
	Bore	S.F. .737; F .812-.815	2	520
	C'Bore	1⅛ x 3.2500		
	Bore	F .750-.751	2	347
	Tap	⅞"—14NF-2	8	115
	Note Shift Part—Repeat operations 3, 4, 5.			
4th SET-UP	Drill	33/16"	4	847
	Bore	.750-.751 x .370	3	565
	Bore	S.F. 1.562		
	C'Bore	F. 1.750 x 3.110	3	375
	Bore	F 1.5745-1.5740	3	520

How the job is run

Machine: Burgmaster 3BH Automatic Hydraulic 8-Spindle Turret Drill.

Part: Machine Slide.

Material: Close grain Moly Cast Iron.

Quantity: 50 per batch.

Holding: Special Pin Locator Air Locked Fixture, for each Set-up.

Closest Tolerances: .0004" on Bores, .001" between Centers.

Tooling: Carbide Tipped Tools.

Floor to Floor Time: 2.5 hours

Former Time: 12.5 hours each on Boring Mill.

Saving: 10 Hours each or 80%.

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills in detail. Twenty-minute 16mm sound film showing Burgmaster turret drills in operation, including the new automatic positioning table, available from any office.

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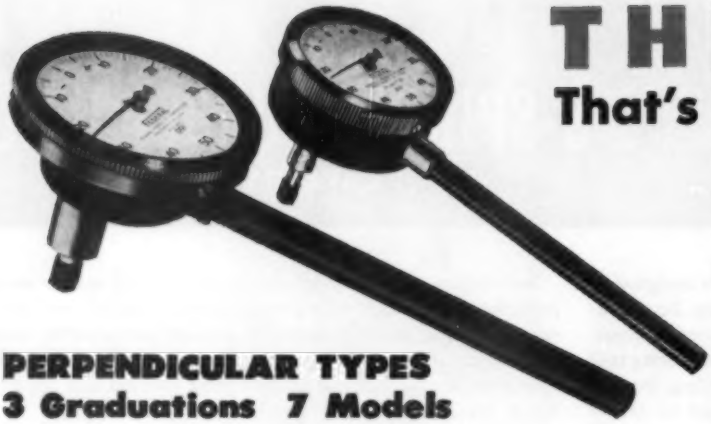


PERPENDICULAR TYPES
3 Graduations 7 Models

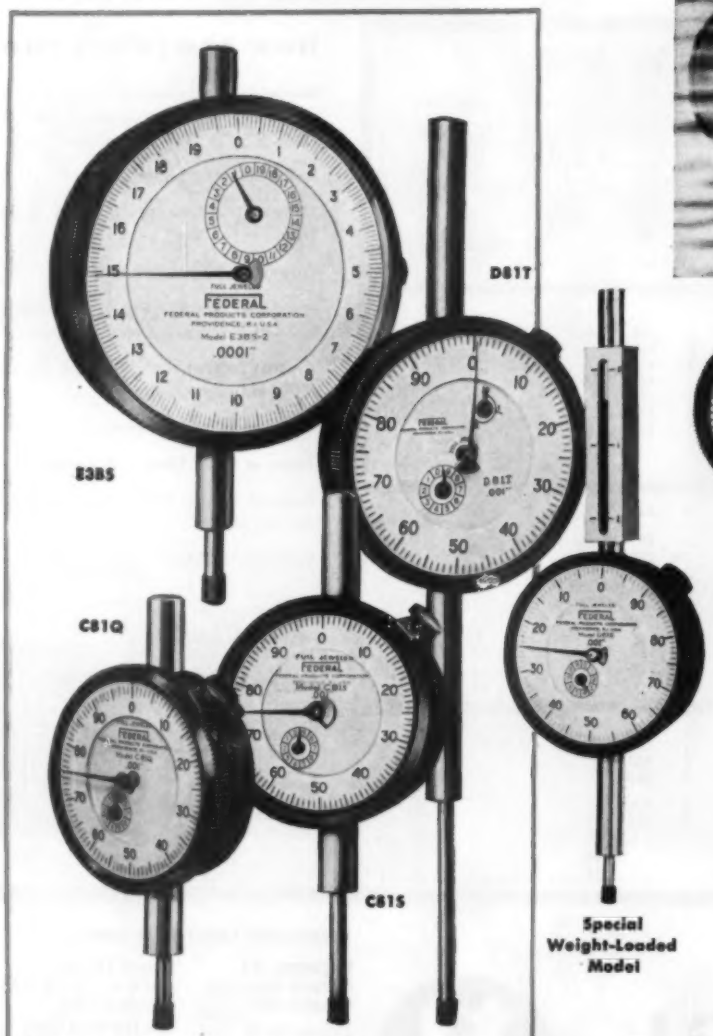
You get the greatest of all selections from which you can pick the right instrument for your job.

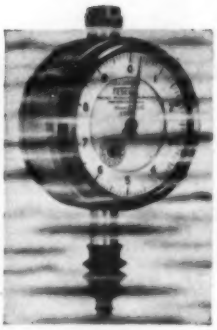
You get the benefits of doing business with a company which consistently offers improvements and new ideas.

You get a known accuracy and dependability built up over years of development and experience.

You save the confusion of stocking and maintaining several different makes of instruments.

LONG RANGE MODELS





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Completely protected from coolant, oil, oil fog, and water. Also protected from dust. Cushioned movement. Extra heavy case for rough usage. Extra strong mounting. Selection of 4 graduations, 6 ranges. A Federal "new".

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Proven winners in competitive endurance tests. Shock is absorbed and prevented from reaching sensitive and precisely aligned parts. No additional friction. No sacrifice in accuracy.

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all Dial Indicators
Yours for the asking
Write

for YOUR MONEY

Standardize on—

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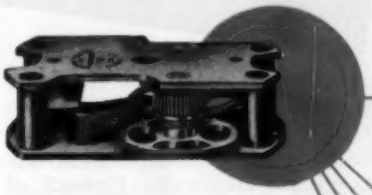

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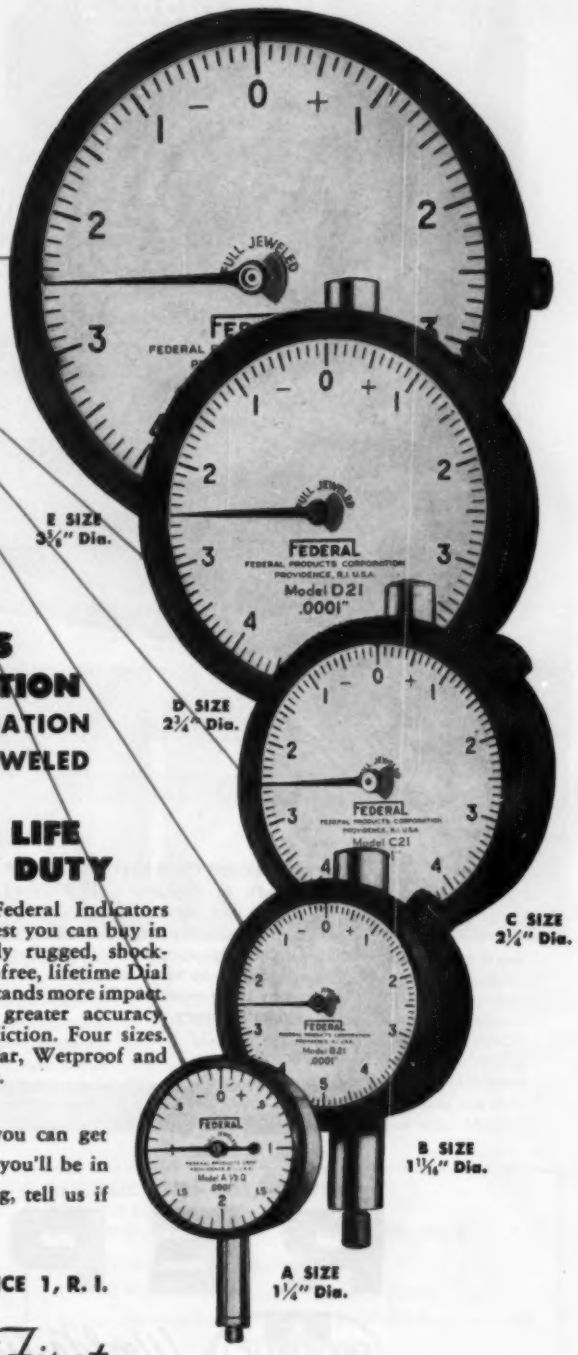
Assures Perfect Alignment Positive Adjustment — Rigidity — High Accuracy . . .

Maintenance men tell us repeatedly it is the easiest to repair.

FIVE SIZES
LOW FRICTION
ANY GRADUATION
PLAIN OR JEWELED

LONG LIFE HEAVY DUTY

Another new in Federal Indicators (H Model). The best you can buy in every way. A really rugged, shockproof, maintenance-free, lifetime Dial Indicator that withstands more impact. Low maintenance, greater accuracy. 16% to 25% less friction. Four sizes. Furnished in Regular, Wetproof and Long Range models.



Whatever you need in Dial Indicators and Accessories you can get from Federal (direct from our Branch Offices too.) And, you'll be in line for new developments later. If you haven't a catalog, tell us if you want one.

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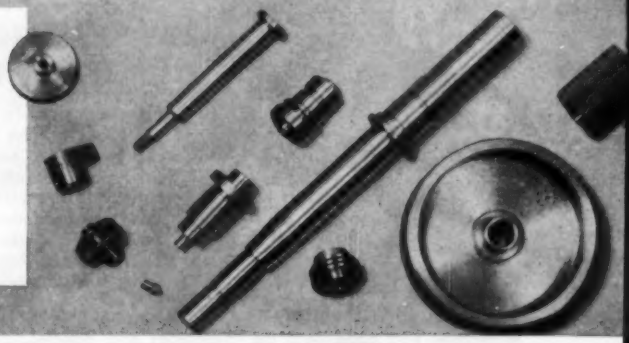
Republic
COLD FINISHED STEEL...

REPRESENTATIVE PRECISION PARTS made of Republic Cold Finished Steel are shown here. Parts like these have an enviable record of reliability—helping National Cash Registers to total more sales than any other machines, for more than a half century.



REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

PERFORMANCE PROVED

in National Cash Registers for over 50 years

The proof of the product is in its performance. That's why we take particular pride in supplying cold finished steel to The National Cash Register Company of Dayton, Ohio.

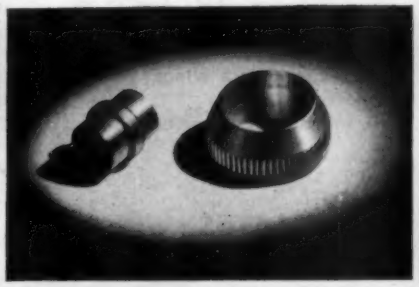
Republic Cold Finished Steel has been helping National Cash Registers ring up sales for more than a half century. Ever since the Union Drawn Steel Company, now our Union Drawn Steel Division, pioneered the cold drawing process, National Cash Register products have totaled enviable service records backed by the uniform excellence of Republic Union Drawn Carbon and Alloy Steel components.

You, too, can capitalize on the many outstanding advantages of Republic Cold Finished Steel. For example, in comparison with hot rolled bars, you get maximum machinability. This feature alone makes possible higher speeds and feeds, finer finished surfaces and longer tool life.

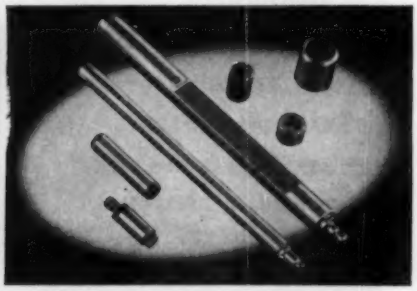
In addition your parts will have higher ultimate strength, yield point and hardness when you use Republic Cold Finished Steel. Extreme accuracy in size and cross section plus an as-received bright, smooth finish enable you to eliminate all further finishing for many applications.

Join the growing list of users scoring production gains through the use of Republic Cold Finished Steel. Contact your Republic representative or your Republic Union Drawn Distributor. Or mail the coupon for full details.

HEAVY-DUTY PERFORMANCE plus minimum weight are provided by these gear train components made of modern, flight-weight alloy steels. Republic, world's largest producer of alloy steels, can help you determine the precise analysis best suited to your application. Result: A superior product combining strength, toughness, and durability — plus production economy.



SUPERIOR MACHINING PERFORMANCE is one of the basic reasons why Flodar, Inc., Cleveland, Ohio, uses Republic Cold Drawn Leaded Alloy Steel for these hydraulic fitting parts. Compared with non-leaded alloy, machining speeds were increased 200%. Also a fine finish, excellent tool life, and negligible scrap loss were secured. Send coupon for data on Republic Cold Finished Leaded Steels.



CORROSION-RESISTANT PERFORMANCE in addition to machinability, strength, and toughness are four good reasons why the manufacturer of these carburetor parts has standardized on Republic Free-machining ENDURO® Stainless Steel Bars. ENDURO is available in a complete range of analyses in cold finished and hot rolled bars, special sections and wire. For complete information, mail coupon today.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. C-2995B
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Please send me further information on:

☐ Cold Finished Steel ☐ Alloy Steels
☐ Cold Finished Leaded Steels ☐ ENDURO Stainless Steel

Name_____ Title_____
Company_____
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City_____ Zone_____ State_____

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Minute Man
KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with this kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

Minute Man

SQUARE BROACHES

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New ROUND BROACHES

Used in an arbor or hydraulic press for finishing holes to exact size in *one pass*. 1/8" to 3/4" squares and hex's; 1/4" to 1" rounds. Production Type Keyway Broaches also in stock.

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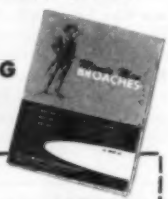


The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Cam miller

Dear Sirs:

We would appreciate more information, or a catalog with prices if available, on the "special cam miller" built in England by Research Engineers, Ltd (*AM*—July 15, '57, p149).

Joe Anton
Anton Machine Works
Brooklyn, NY

We have checked and find that at present this company does not have US representation, so we can only suggest that you write them direct: Research Engineers, Ltd, Northampton Grove, Canonbury, London, N 1, England—Ed.

More on stripper design

Dear Sirs:

Referring to the controversy on stripper design (*AM*—Aug 12 '57, p78), I would like to report the findings of some small-scale practical experiments which I made some time ago.

I found that Mr. Paquin's discussed factor "855" is much nearer to the truth than the exaggerated "3500" mentioned by Hinman. According to my findings, in the case of soft steel, the factor varies between 900 and 2700, and in the case of soft brass, between 600 and 1800. (All these factors are in terms of lb per sq in. of cutting surface, i.e. cutting perimeter multiplied by stock thickness.)

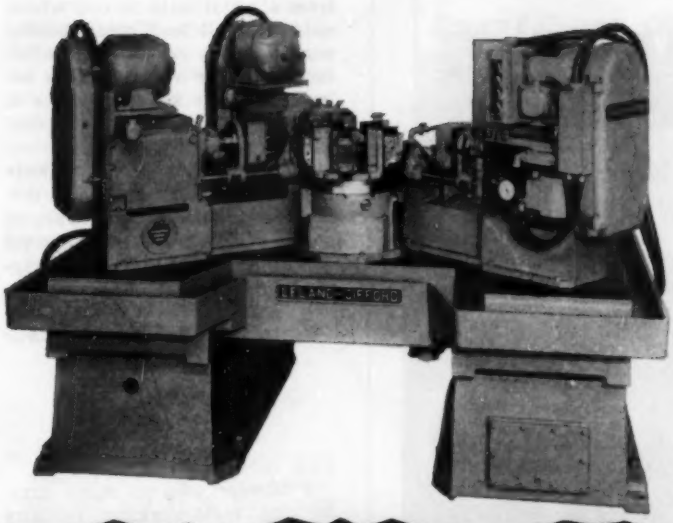
This great variation (a ratio of about 1 to 3) is due to the following circumstance. I found that in addition to the commonly known determining factors (kind of stock, its surface finish, its thickness, its hardness; punch dimensions, surface finish of the lateral sides of the punch, clearance between punch and die opening, clearance between punch and corresponding opening in the stripper plate, stiffness of stripper plate, die design, lubrication, etc.) it is very important how much material surrounds the punch.

It is quite a different proposition to pierce a small-diameter hole in a large panel or sheet from the case of blanking large blanks

SHOPMATES

N. JARVIS

—ACTUALLY—ER— IT'S MACHINED .003" UNDERSIZE— B-B-B-B-BUT IT COULD BE THAT Y'CAN'T TELL WHETHER IT'S A "2" OR A "5" ON THE PRINT— ER—THAT IS— GULP—THE TOOL COULD'UVE— NO IT COULDN'T EITHER— MAYBE THE GAGE— THAT'S IT! THE GAGE!! —MAYBE THIS STEEL SHRINKS ??
JEST BE GLAD YOU DIDN'T GROW UP TO BE AN INSPECTOR! THERE'S A MISTAKE SOMEWHERE AND IT'S HIS FAULT FER FINDIN' IT!!
N. JARVIS

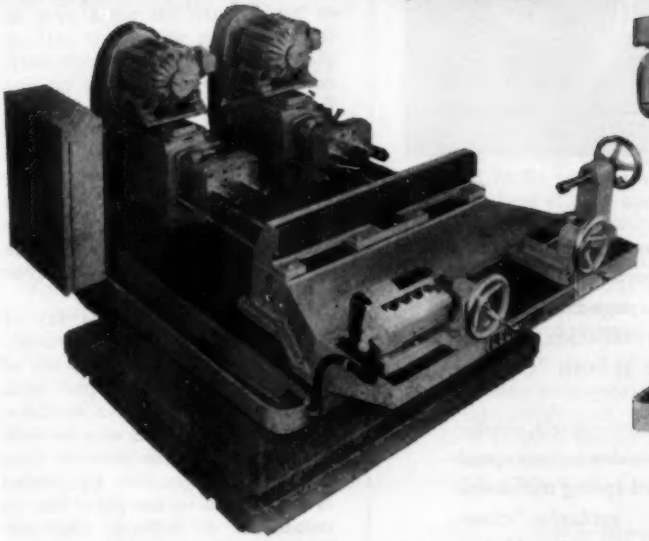


Mechanize Hand Operations

THE JOB — Drill and ream four holes on the face and two ends of automatic transmission valve body.

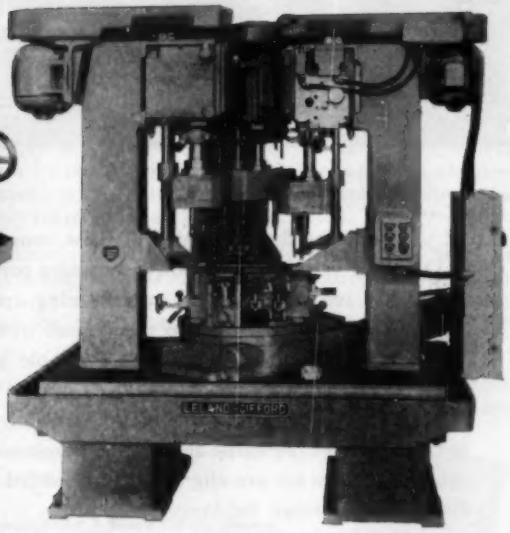
THE SETUP — Three No. 2 self-contained deep hole units with 2-spindle multiple heads and a 5-station hydraulic indexing station. Production: up to 120 pieces per hour.

LELAND-GIFFORD *Special Drilling Machines*



THE JOB — Drill and ream two .750/.751 dowel holes in 4 and 6-cylinder engine blocks.

THE SETUP — Two No. 3 self-contained units with 2-spindle heads mounted on a special base with work holding and positioning fixture.



THE JOB — Drill and ream 9 holes in one face and 2 deep angular holes in one side and one end of a control valve housing.

THE SETUP — One No. 3 and two No. 2 self-contained units with multiple heads vertically mounted over a 2-station automatic indexing table.

Contact the office nearest you for help with your drilling problems.

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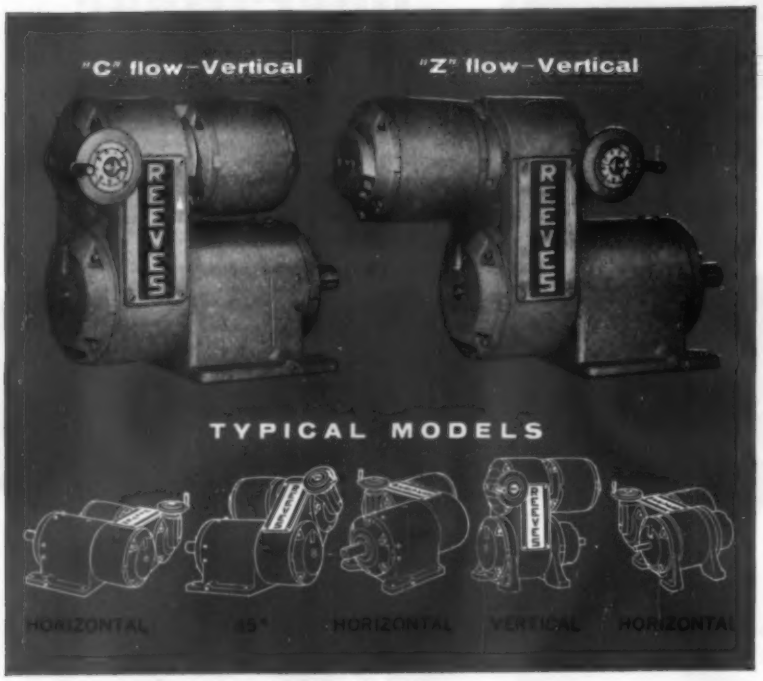

The flexible design of these compact new REEVES variable speed power packages permits hundreds of combinations . . . space-saving, space-fitting *standard* assemblies to meet most installation requirements. All models are available in both "C" flow and "Z" flow styles.

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REEVES PULLEY COMPANY

Division of **RELIANCE** ELECTRIC AND ENGINEERING CO.

Columbus, Indiana

from a metal strip or coil where only a small and weak border surrounds the punch. In this latter case, all other conditions being equal, the stripping force is about one-third that of the first case.

Mr. Paquin is quite right. There are many obscure corners in die-making which should be explored systematically, and the correct determination of the actual stripping forces is one of these tasks.

Federick Strasser
Santiago, Chile

Why?

Dear Sirs:

I wonder why so many firms in the metalworking industry spend large sums of money for fixtures and for high-speed precision machinery, and yet they seldom allow enough for gages to check the work produced by all this valuable equipment.

I wonder why the project engineers and tool engineers don't provide a reasonable budget for gaging; why the production worker has to turn his parts over to the inspectors with their surface plates, height gages, micrometers, calipers, rods, etc, before he can find out if he is making good parts. The resulting squabbling and lost time could be eliminated by a simple, accurate indicating gage that would allow inspection at the point of production. At the same time, it would be a large step forward in the field of labor relations.

I wonder why, in this day of time study, no one to my knowledge has studied the amount of time it takes to gage a part with antiquated methods vs modern, efficient gaging; and why nobody has considered the cost of time lost while expensive equipment is shut down so the parts can be measured, a tedious, time-consuming operation with the traditional inspection tools, but a job that takes only seconds with the more-economical dial-gaging methods that are now available.

I wonder why so many of the firms that do provide gages are buying thousands and thousands of dollars worth of old-fashioned master rings for zeroing their dial gages. The rings are money down the drain. They become nothing but scrap after the job is completed, or else they have to be reworked at considerable expense

for any other job. Adjustable masters, on the other hand, have proved just as accurate; they can be set with gage blocks for one job after another; and they are available for bore gages, snap gages, depth gages, etc. But this seems to be one instance where the metalworking industry is slow to adopt progressive and inexpensive equipment.

I wonder why.

Ray Danese, Sr
Vice President, Boice Gages, Inc
Hyde Park, NY

CALENDAR

AMERICAN GEAR MANUFACTURERS ASSOCIATION — Semi-annual Meeting, Oct 27-30, Edgewater Beach Hotel, Chicago, Ill.

AMERICAN SOCIETY FOR METALS—National Metal Exposition and Congress, Nov 4-8 (World Metallurgical Congress, Nov 2-8), International Amphitheatre, Chicago, Ill.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS — Annual Machine Tool Conference, Nov 4-6, Hotel Schroeder, Milwaukee, Wis.

AMERICAN STANDARDS ASSOCIATION —National Conference, Nov 13-15, St Francis Hotel, San Francisco, Calif.

INVESTMENT CASTING INSTITUTE — Annual Meeting, Nov 19-20, Sheraton Hotel, Chicago, Ill.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Annual Meeting, Dec 1-6, Statler Hotel, New York, NY.

SOCIETY OF AUTOMOTIVE ENGINEERS — Annual Meeting and Display, Jan 13-17, The Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

SOCIETY OF AUTOMOTIVE ENGINEERS—Production Meeting and Forum, Mar 31-Apr 2, The Drake, Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS—Aeronautic Meeting and Display, Apr 8-11, Hotel Commodore, New York, NY.

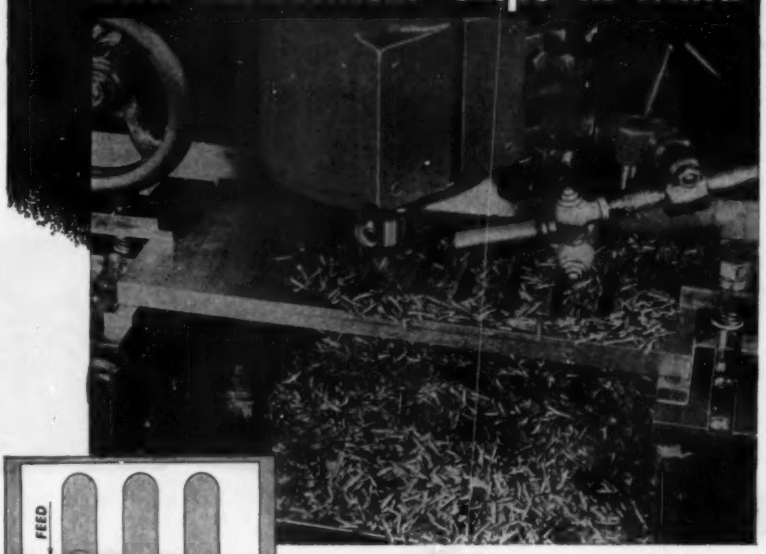
AMERICAN WELDING SOCIETY — Spring Meeting and Welding Show, Apr 14-18, Statler Hotel, St Louis, Mo.

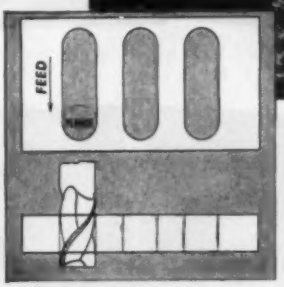
AMERICAN SOCIETY OF TOOL ENGINEERS — Tool Show, May 1-8 (closed Sunday), Convention Center, Philadelphia, Pa.

AMERICAN SOCIETY FOR METALS — Southwestern Metal Exposition and Congress, May 12-16, State Fair Park, Dallas, Texas.

Brown & Sharpe CHIPS

End Mills Designed with Economical Chips in Mind





Center cutting End Mill plunges vertically into workpiece. When milling a slot to desired width, metal removal is concentrated on the peripheral teeth.

High Speed Slotting with High Speed Steel End Mills

The cutting efficiency designed into Brown & Sharpe Fast Spiral End Mills is shown by the accumulation of large, uniform chips—your best clue to cutter performance. Even at high speeds, the chips flow smoothly away from surfaces being machined.

Each tooth of a Brown & Sharpe PRODUCTIONEERED End Mill is ground with double-angle lands . . . combines correct relief with increased strength of the cutting edge. Fast Spiral End Mills are especially designed for rapid cutting action, reduced power consumption.

Whether you specialize in long production runs, or perform precision toolroom work, milling cutter efficiency is an important item in your budget. For maximum speed, accuracy —and economy—always specify Brown & Sharpe PRODUCTIONEERED Cutters!

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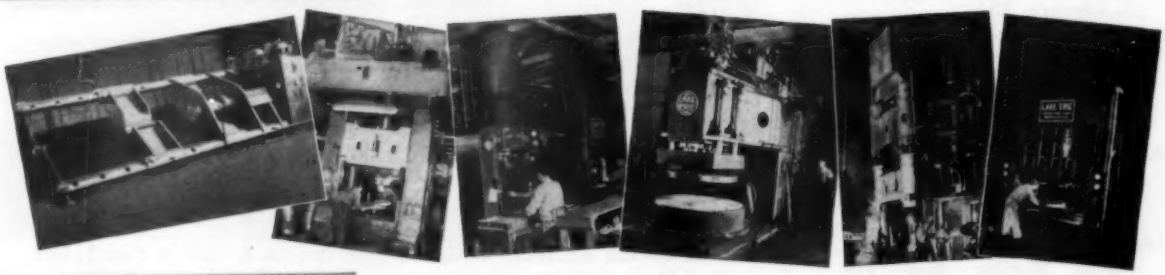

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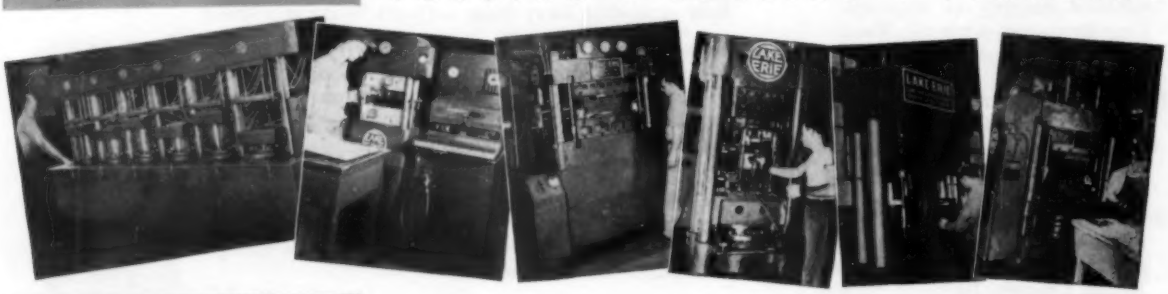

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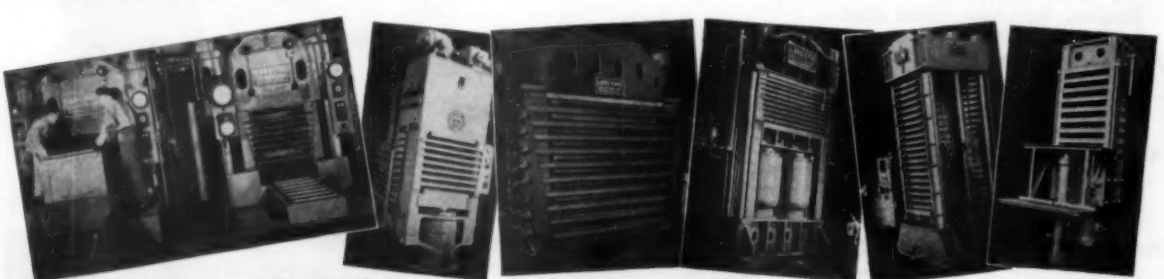

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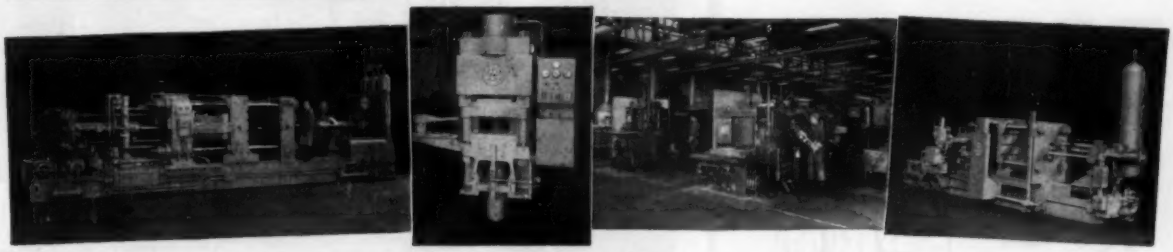

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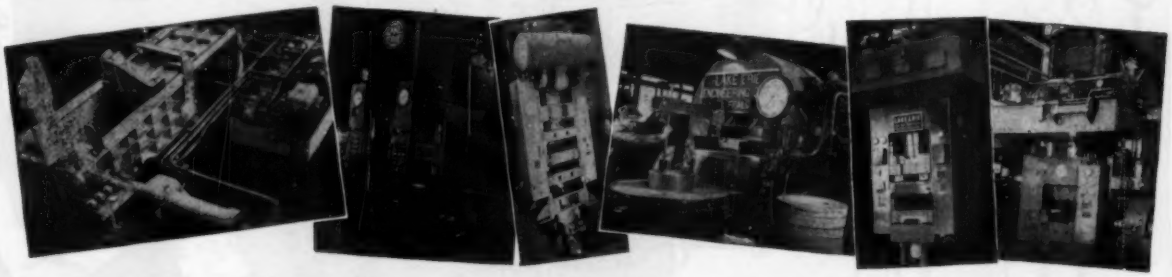

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Production Engineers, General Managers, Shop Superintendents, Foremen, and other operating and executive personnel in more and more plants are taking a close, *close* look at the all-new, Full Electrically Controlled King® Vertical Boring and Turning Machine. And they *like* what they find . . . things *you* ought to know, too!

It adds up to this: the new King® will give you a *greatly increased production capacity* for your boring and turning work —a production capacity that is a "must" to meet stiffer competition in these days of continuously stepped-up speed in machine tool operation and control.

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AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

Spot news...

- **Water-soluble cleaning fluids are being tested at Oldsmobile for honing** of cylinder bores. Idea is to eliminate inflammable liquids in this operation.
- **Rehiring of rank-and-file striking employees on a probationary basis,** and summary dismissal of strike leaders marked Lone Star Steel Co's drastic method of dealing with a wildcat walkout of 2500 workers.
- **Control of tolerances will become increasingly important in hot machining** of high-speed materials for aircraft. One means toward this end: induction heating of the surface of bar stock or forgings ahead of a cutter.
- **California study of how 1200 apprentices have fared** since becoming journeymen in 1950 shows they are earning an average of $1400 a year more than production workers, 43% are getting above-scale wages, 30% are working for the same firm, about 88% had steady work in 1955 (no lost days), 92.7% are still in the trade, and 43% have supervisory or management jobs.
- **Vinyl-coated steels are being studied by producers of auto trim** and accessories for '59 models. One problem: how to stamp, form and weld without damaging vinyl in exposed areas. Another: how to keep from getting a poor joint in concealed fastening areas.
- **Proof that Japan still relies upon the U S and Europe** for most of its metalworking machinery: $409 million worth of machinery was imported last year, compared with 1955's $166 million. Major imports include: metal-processing machinery, 31%; electrical machinery 31%, other industrial machines 9%.
- **Creep forming can eliminate hand operations in aircraft parts manufacture,** it was reported at SAE's recent Aeronautic meeting. Parts are formed on conventional equipment, then stress relieved and creep-formed for from 30 seconds to 5 minutes in hot dies in a hydraulic press.
- **Lithium-aluminum alloy that maintains high strength up to 400 F,** developed by Alcoa Research Labs, has pushed the aluminum thermal barrier ahead by at least 100 F. Now for the first time, aluminum alloy skins can be used for aircraft traveling 1600 mph. Alloy is called X2020, is 3% lighter than any other aluminum alloy for aircraft.
- **Maximum machining temperatures at which adhesives can effectively bond** cutting tool tips to tool shanks, as researched by the Army are: room temperature to 240 F for ceramic tools, up to 250 F for cemented carbides, 270 F for tool steel.
- **Automatically programmed resistance-welding machine** is cutting assembly and weld time 85% in the welding of tabs on cylindrical liners for jet engines at GE's Small Aircraft Engine Dept, Everett, Mass. GE figures the machine will effect $26,000 annual savings.
- **"Martyr metal" cadmium coatings that sacrifice themselves** rather than allow basic load-bearing plane parts to corrode or weaken have been developed by Lockheed. Ultra-high-strength steel parts for jet planes are plated with cadmium in 5 by 5 ft dia vacuum chambers

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announcing

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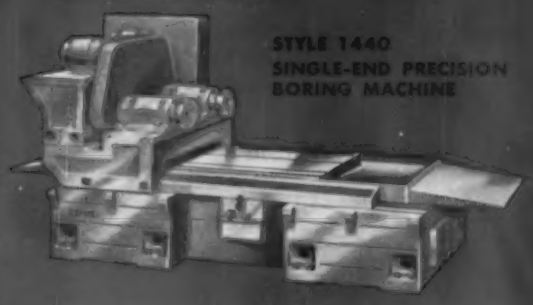

TWO NEW HEAVY DUTY PRECISION BORING MACHINES

57-76

EX-CELL-O BORING MACHINES perform better because of deep-down solid construction, high precision and exceptional versatility. The minute you put one to work profits go up, operating costs go down. And these two new additions to the Ex-Cell-O line are no exceptions:

DOUBLE-END STYLE 2440: This new double-end Ex-Cell-O machine, designed for large workpieces, combines capacity and rigidity for bulky parts while allowing for multiple-station high production work on smaller parts. Spindle bridges can be moved together or spread apart to suit the workpiece.

SINGLE-END STYLE 1440: This new heavy-duty precision boring machine is identical to the 2440 (above) except that it is equipped with one bridge for single-end operations.

Whichever model fits your particular production requirements—you'll find their rugged versatility performs a wide range of rough, semi-finish, and finish operations which lowers your per-unit costs, increases your potential profit.

For further information, call your local Ex-Cell-O Representative. He'll provide all the facts about these two new machines. Or, write direct to Ex-Cell-O.

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Washington ... NEWS REPORT

Sputnik generates "flap" ...

Moscow's success with "Sputnik," its earth satellite project, has stepped up demands for a speed-up in the US ballistic missile program.

But up to now the administration's reaction is this: the US earth satellite, Project Vanguard (for which the first test launching is not scheduled until December), has been kept at a low priority so as not to "interfere" with ballistic missile development. Administration officials stress the two projects are separate and that Russian success with an earth satellite doesn't justify belief that the Russians are also ahead on the ballistic missiles.

The critics scoff at the argument, claim that success with Sputnik is based on rocketry exploited also for long-range ballistic missile firings.

Outlook for missile program ...

Despite all the furor, the administration has no plan to speed up either the ICBM-IRBM or Vanguard projects.

Says President Eisenhower: Sputnik doesn't raise "my apprehensions one iota." It isn't significant from a security standpoint. There have been no unnecessary delays in the US program.

The new Defense Secretary, Neil H McElroy, says the same thing: "The missile program is moving along well within the limits of scientific knowledge."

All this boils down to the fact that spending for the big ballistic missiles will not increase. Indeed, some of the individual projects in the overall ICBM-IRBM program are being scaled down—such as Titan and Polaris—or will be eliminated—either Thor or Jupiter.

Right now, the Pentagon is spending close to $3 billion annually to produce and develop missiles—at least half of which is earmarked for strategic ICBM's and IRBM's. This is roughly $400 million more than last year's expenditures.

Whether more money could be profitably spent at present is problematical. The biggest beef—even from the most severe critics—is not over total availability of money, but rather over how chunks of the available funds have been commited.

Organizational revamping?

All the fuss over the alleged US lag behind Russia in long-range ballistic missiles may lead to this: an organizational shakeup resulting in more centralized control over development and production.

According to an authoritative Pentagon source, "as late as a few weeks ago," ex-Defense Secretary Wilson contemplated the creation of a single Defense Dept agency to take over work on ICBM's IRBM's, and anti-missile missiles. He was finally persuaded against this by military officials who argued that such action "would interfere with service efforts."

The new Russian success with an earth satellite —reflecting significant progress over the US in rocket technology—now plays up the need, however, for some kind of revamping. And in the words of one high-level Pentagon official, there's "a real possibility now" that a "common agency of execution—as opposed to one with only staff responsibilities—will be set up to assemble all our ballistic missile resources under one roof."

Says this official: "Despite all the talk you get from people like Symington, it can be demonstrated that money has nothing to do with the missile situation. The main difficulty is the diversification of our technical resources and competing missile programs."

Status of Vanguard ...

The Pentagon makes no secret that Vanguard has been treated as a low-priority project. This decision, says one top official, was made because "it was felt that playing around with the satellite for IGY would interfere with the military ballistic missile program." Indeed, he says, if it had been known at the outset that Vanguard would cost over $110 million—instead of the initial $22-million estimate—it's doubtful the project would have ever been okayed.

As it was, Vanguard got under way on its own with little if any liaison with military ballistic efforts—as a means of playing up its purely scientific nature and its removal from military operations (the current schedule calls for the first test launching in December). As a result, Vanguard scientists have had to fight hard for their funds—and would like to have more. Wilson has grudgingly increased the project's budget, but only with angry murmurs that he saw no reason why the Defense Dept should bear such costs. Wilson said repeatedly he saw no military value in getting to the moon first.

Along the same lines, the administration has been underplaying US ballistic missile achievements. It's been preoccupied with efforts not to rattle the sabre.

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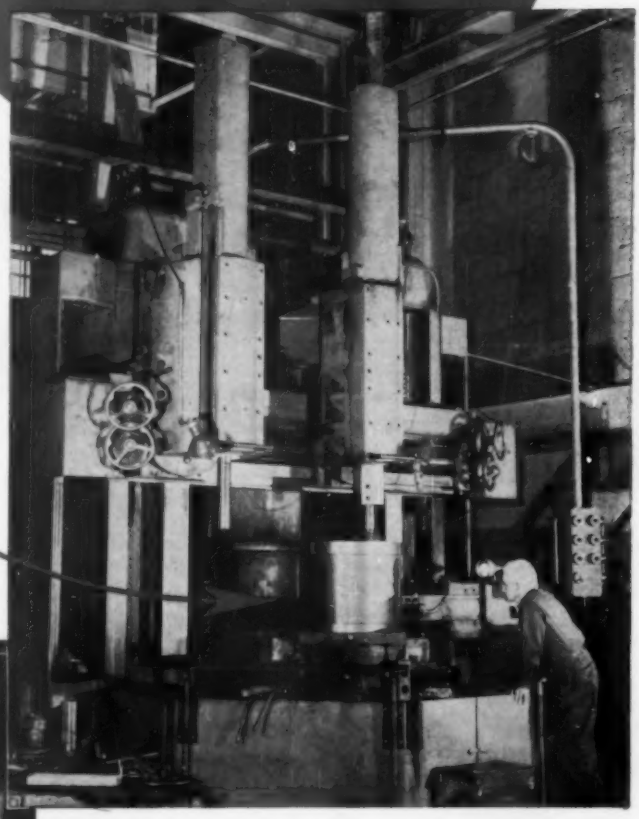
In the machining of a barrel housing used in a large mechanical press, manufactured by the Clearing Machine Co., Chicago, Ill., Mr. L. W. Prochnow, Factory Manager says "our 66" Cut Master, Model 75 is a big, husky machine. Its heavier rams, overall rugged construction and greater horsepower provide higher speeds and feeds easily controlled from the movable Pendant. These features enable us to cut our floor to floor time, per piece, by four hours. And we've had no maintenance problems in nearly two years of operation." These same cost savings can be applied to your machining problems when considering replacement or additional capacity in your plant.



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Detroit ... NEWS REPORT

US-built small car for Ford?

"Ford is seriously considering stateside production of a small car," James J Nance, head of the newly combined Lincoln and Mercury divisions, said recently. It is believed that the go-ahead button will be pushed by Ford when foreign car penetration of the U S market exceeds 5%. The figure now stands at 3.5% without much help from GM's Vauxhall and Opel lines, or Studebaker-Packard's Goggomobile. But it's a far different case with Germany's Volkswagen.

The Volkswagen is in such demand over here that bootlegging has reached epidemic proportions. According to the National Automobile Dealers Association, some sharp operators are buying up Volkswagens in Europe from cab companies, for-hire outfits and so on and importing them as new into the United States, mostly through Mexico.

The Volkswagens in question lack sealed beam lights, turn indicators, safety glass and other items required by U S law. Added up, these accessories come to about $300. On top of that, the car is a thoroughly used one. But in a backhanded way this "new used car" racket is a tribute to the desirability of the Volkswagen.

October output below '56 levels ...

October auto production is running below 1956 levels—primarily because of Ford's late mid-month start.

In consequence, Chrysler Corp will attain an unprecedented lead over Ford for the month—one that will boost Chrysler's market penetration to more than 21%. The independents, American Motors and Studebaker-Packard, have already reached their expected high monthly output of 10,000 units each.

Major truck manufacturers produced close to their 95,000 unit norm in October—with most offering restyled, 4-headlight models in every weight class. Ford sold a surprising 19,000 flashy "Ranchero" trucks in its first model year, proof that appearance and comfort are becoming major factors in the pickup truck market. Most sales are in rural areas to those who want to keep up with Farmer Jones.

Chrysler's long chance ...

Styling changes on Chrysler Corp's 1958 lines can hardly be described as startling. In fact, it takes a practiced eye to distinguish them from the 1957 models, but Corporation officials are firmly convinced that Chrysler didn't need major styling changes this year.

States Chrysler President Colbert, "To make gains of the kind we have been making, an automobile company must bring something to the market that sets in motion a change in product allegiance and a change in public taste. The facts show our cars have done both of these things."

Colbert refers to his company's record 21.5% share of the '57 market—a figure he hopes to increase this year.

Even if Chrysler just manages to hang on to its 21.5%, the effect on auto thinking will be drastic: a company could avoid costly every-year major changes and still grab off a sizeable share of the total market. If Colbert's expectations work out and Chrysler is successful, look for other automakers to follow suit—and this could be a real blow to tool and die people and other auto industry suppliers.

Horsepower juggling ...

Spotty obedience to auto manufacturers' highly touted resolve to end the horsepower race has produced some curious results. Plymouth's Golden Commando, for instance, actually boasts 5 hp more than the standard Cadillac.

There's little doubt that the ending of the horsepower race killed chances for widespread application of fuel injection. For 1958, only Chevvy, Pontiac and Chrysler lines offer it at option.

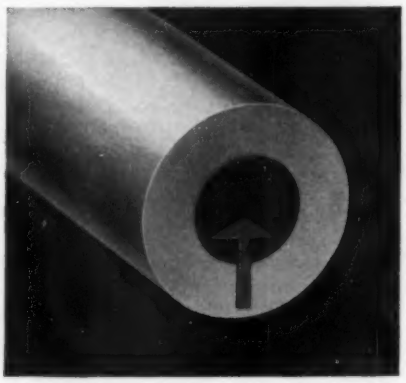
Finis to Nash and Hudson ...

At long last, the slow-dying Nash and Hudson nameplates have been dropped by American Motors.

Now the onetime Nash Ambassador is designated as "Ambassador by Rambler." That means American Motors' 2200 dealers will have to get new neon signs. It also marks a pretty complete revamping of the AMC setup, which is geared to Rambler output. AMC's '58 product lineup features interchangeability of parts, particularly body ones—a move that spells production economy and increased profit for American Motors.

AMC's new Baby Rambler is a replica of its 1954 model in almost every detail. In fact, preview prototypes were reworked from used '54s bought on Detroit lots. The grille is new, the front and rear fenders have been cut away, and the roof and trunk silhouettes are a little flatter, but the whole thing was done by modifying the dies used to produce service parts. Even the engine is a revival of AMC's durable L-head six, but it's still an appealing little car.

a hole here is a hindrance...



a hole here is a help

Crucible Hollow Tool Steel sections, cut to length, save you time and money when you make ring-shaped, or tubular parts, or tools with a center hole. Because these tool steel sections are already drilled through when you get them, you don't have to bore, drill, cut-off or rough-face. Production time goes down, and most scrap losses are eliminated.

Five popular grades of Crucible tool steel are available immediately from warehouse stock, in hollow-disc form. They are KETOS oil-hardening, SANDERSON water hardening, AIRDI 150 high-carbon, high-chromium, AIRKOOL air-hardening, and NU-DIE V hot-work tool steels. Order the O.D. and I.D. combination, and length and thickness you need.

Let your Crucible representative show you how hollow tool steel sections can reduce production time, and save you money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

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Aircraft and Missiles...

NEWS REPORT

Subs battle for survival...

The Air Force's recent announcement that it will limit the amount it will pay each month to makers of jet aircraft and missiles (see p193) has just dealt a second numbing blow to an industry still shocked by the abruptness and extent of recent defense cutbacks.

The limited monthly payment plan not only will delay and roadblock production in prime contractors' plants, it is expected to cause further layoffs. And as surely as night follows day, it will mean a further pullback of subcontracting work into prime contractors' shops.

And where does that leave the small subcontractor? His battle today is one of survival. Take, for instance, the 114 member companies of the three-year-old Strategic Industries Association —firms in six states that make a wide variety of defense components, and perform many specialized metalworking operations, such as skin and contour milling.

Average employment among SIA member firms has dropped from 70 people last year to 53 today. Many of the companies have had to let workers go, others have gone into bankruptcy or have otherwise retired from business.

The Association was formed in July, 1954, when subcontractors had their backs to the wall following drastic post-Korea defense cuts.

Its sole purpose: to help the small manufacturer survive in the face of reduced defense spending.

Now that problem is magnified as never before, and added to it is the far-reaching switchover from manned aircraft to guided missiles.

From a defense standpoint, the Association feels that it is no more than common sense to keep the nation's small manufacturers active. Often they are better equipped than the primes to do specialized jobs, and in case of a national emergency they can expand more rapidly. But SIA objects to the government's growing practice of doling out defense orders just to bolster "distress economy" areas.

What, then, will help the small defense manufacturer get back on his feet? Here are a few things: prompt termination settlements at all procurement levels, allowability of interest as a legitimate contract cost—and the end of all forms of government subsidy.

Those are some of the objectives of SIA. Others: uniform security regulations, and uniform quality standards for all military production. Too, member firms are regularly informed on new procurement regulations, contract requirements, wage-hour laws, and means of obtaining government contracts. Member companies discuss problems at regular area dinner meetings, try to work out solutions to their mutual benefit. And SIA recently held a course in quality control for its members, expects to hold similar courses in other fields in the future.

In coming years, many of this country's estimated 40,000 small manufacturers will be faced with problems that challenge their very existence—particularly in view of prediction by top military experts that by 1961 60% of U S aircraft production facilities will be considered excess.

Is the answer diversification into civilian products? Is it pressuring the government into making it mandatory for primes to allocate a fixed percentage of business to subs? Even SIA, whose members would stand to benefit from the latter measure, is opposed to it, claiming such a move would be "impractical and grossly uneconomical."

Designated by SIA as "Villain No. 1" for the small aircraft manufacturer is the Renegotiation Act.

Under it, the large prime is required to kick back so-called excessive profits to the government. Its effect has been to inspire primes to pull back as much work as possible into their own plants so that they can maintain acceptable overhead precentages and justify their profits. **But such curtailment** on the letting of subcontracts is unhealthy, SIA maintains, because the resultant cost is killing off economical specialty shops and ultimately causing an increase in total defense production expenses.

High on the list of inequities cited by SIA is a growing trend of primes to bid among themselves for subcontracts.

According to the Association, with the dip in military contracts and the changeover to missiles it makes sense to the prime airframe producer to reactivate idle metalworking equipment by obtaining subcontracts from other primes. Admittedly, this is sound business, but SIA feels strongly that it's unfair competition if the prime uses government-owned facilities to do it.

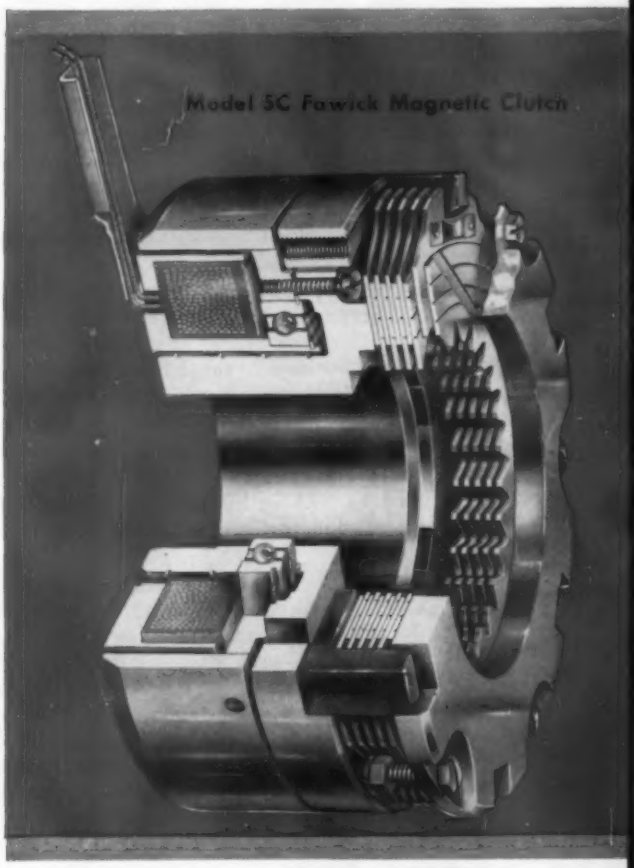
In instances wherein the prime has pulled back such jobs as stretch-press work, heat treating, electronic cable production and other specialized functions, SIA holds that such work can better be done by a sub with solid experience in the field.

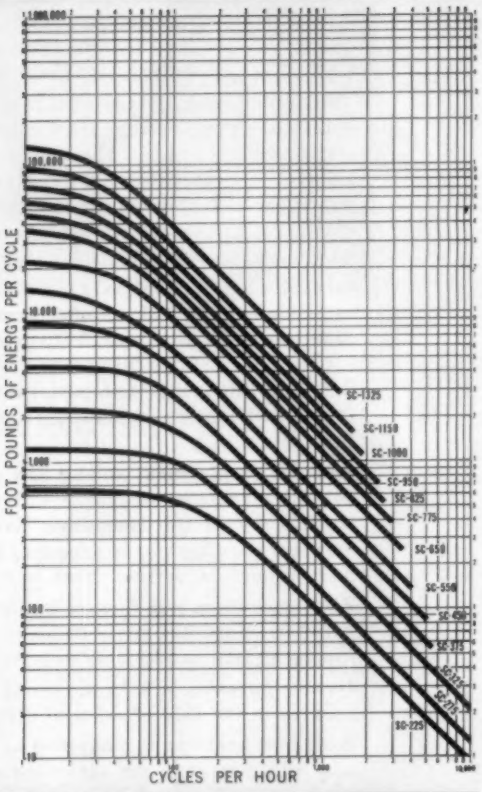
SIA feels, too, that inequitable tax burdens are a cause for much of the small manufacturer's dilemma today. Its solution: **eliminate all taxes** over 50% of income.

FAWICK MAGNETIC

CLUTCHES & BRAKES

produce *dependable* torque output





For rated torques from 36 to 48,000 in.-lbs., FAWICK Magnetic Clutches provide thoroughly dependable, full-power output. This is the result of a patented, functional design and quality construction.

Look at the *reliability factors* which are designed into and built into FAWICK Magnetics:

- **excellent heat dissipation (see chart)**
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- **all materials selected for long life**
- **operating parts precision aligned and balanced**
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These factors enable FAWICK Magnetic Clutches and Brakes to keep delivering top performance over an extra-long service life with minimum maintenance.

FAWICK Magnetic Clutches and Brakes are produced in sizes from 2 to 13 inches in diameter for use on machine tools and automatic machinery. For further information, write for Bulletin M-101 or contact your nearest FAWICK representative.

Excellent heat dissipation characteristics of Fawick Magnetic Clutches permit operation under severe conditions (high speeds, high cyclic rate, fast acceleration and deceleration) with no appreciable loss of efficiency.

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Machine tools ... NEWS REPORT

Orders on skimpy side ...

September's new orders for machine tools are estimated to have been little better if any than August's. October has started off with small promise of any sizable pickup. At this point, fourth quarter business looks as though it will be on the skimpy side.

Aside from a 1959 engine program for General Motors Truck & Coach, the prospect of important business out of the automotive field appears dim. A flurry of excitement is reported from Detroit in the appearance there of purchasing officials from foreign automobile companies. Whether they will place any machine tool orders remains to be seen.

Within the past year or two, U S tool builders received substantial bookings from western European automobile makers with big expansion programs.

Automated gaging units doing well ...

Automated gaging machines have come in for a lot of attention in the Detroit area in particular. Aircraft companies also have been important buyers of this type of equipment.

The relatively poor volume of orders recently has not discouraged many machine tool builders, who think that 1958 will be better than this year. One well-known company is convinced that next year will be good, with selling concentrated on replacement rather than expansion and with competition very rough.

GM not to make small car ...

There is nothing to the story that General Motors is about to ask for bids on tooling for a small car to be produced in a U S plant.

The small car market "does not seem substantial enough to interest us at the moment," a Chevrolet spokesman states. He went on to say that Chevrolet has no plans to make such a car in this country. It intends to wait and see what success is achieved by the importation of Vauxhall and Opel cars from England and Germany during the next year. Important rate will be 1000 cars of each make a month.

K&T buys into CVA ...

Kearney & Trecker Corp has acquired a half-interest in C V A Jigs, Moulds & Tools Ltd, Brighton, England. The latter is one of Britain's prominent machine tool builders.

Since 1947 C V A has been licensed to build and sell certain models of K&T milling machines in foreign markets. It recently has started manufacture under license of Lodge & Shipley lathes. It also makes automatic screw machines, presses, chucks, dies and jigs. Eric Aron is managing director. The company has experienced a sharp expansion in the past 10 years.

Team to India reports ...

Proposals for encouraging U S machine tool exports to India and U S capital investment in manufacture of machine tools in India have been made in a report to the Indian government by a four-man U S task force headed by George E Merryweather, vice president and secretary of the Motch & Merryweather Machinery Co. The report is the result of an on-the-spot survey of Indian conditions made under sponsorship of the International Cooperation Administration.

Liberalization of Indian tax rules governing royalties and of income taxes on foreign nationals was one of the recommendations. The team reports that U S firms might be able to negotiate special concessions from the 62½% tax on royalties.

Establishment of a government-owned "bank" of machine tools to be leased to Indian machine tool builders was another recommendation.

Priorities on materials and other supplies should be given India's machine tool industry under India's second Five-Year Plan, the team reported. This industry is India's "primary manufacturing industry."

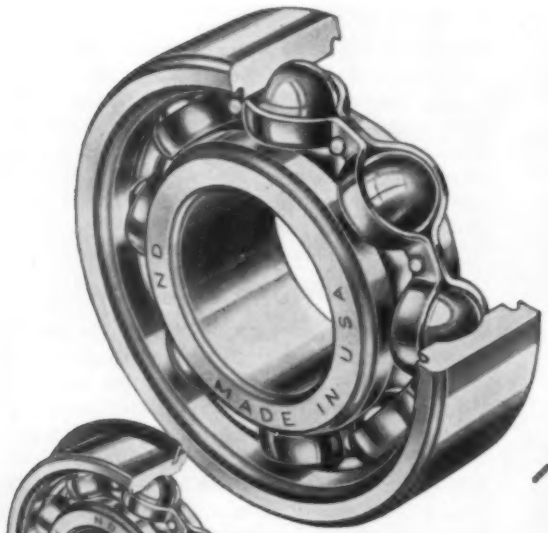
Simple standard tools needed ...

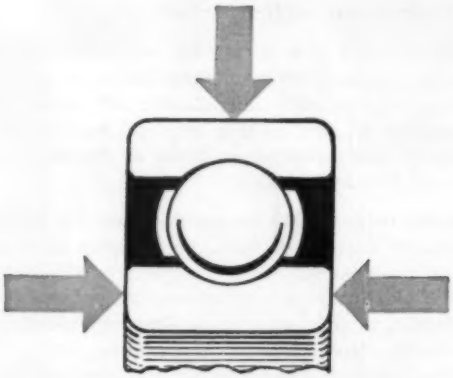
India's three government-owned machine tool building plants produce costly, high-precision machines unsuited for the Indian market.

Simple, general-purpose tools without frills are needed by India's machine tool users—small manufacturing plants, railway repair shops and the like. India does not have mass-production factories.

U S and Indian governments have agreed upon currency convertibility guarantees to encourage private U S investors. On the other hand, the Indian government has given no assurances that it will accept the machine tool team's advice.

ND FACTS





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Fits because—this basic New Departure ball bearing, more widely used than any other antifriction type, does much more than carry RADIAL loads—it locates the shaft it supports against THRUST LOADS FROM BOTH DIRECTIONS equally well!

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ND NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

What's ahead ... in Metalworking

NEWS REPORT

Production: running steadily in the '57 homestretch...

Metalworking has gone into the year's final quarter with virtually no diminution in the production rate, though operations will not set any records.

The main worry does not center around output. It focuses on new business, which is not coming in at the hoped-for level.

Capital goods in particular have suffered from the tendency of buyers to wait and see what is going to happen. Piled-up orders have been decreasing in size for some time, and no end to this downward trend is yet in sight.

Metalworking has been feeling the effects recently of the lull in automobile activities as car makers change over to new models. On the other hand, the production rate will get a big boost before long when Detroit starts large-scale assembling 1958 models to stock dealers.

The squeeze on defense spending, involving chiefly the stretchout of current programs as well as the cutting back of future plans, is resulting in some layoffs by aircraft and associated plants. But the decline in employment should not be exaggerated beyond its modest proportions. Defense production will still be very big throughout the government fiscal year (up to July 1958).

Makers of heavy electrical equipment say that production is continuing at top volume and backlogs insure full operations for months ahead.

Steel buying lags...

Anticipated upturn in steel orders has not taken place. There has been a conspicuous absence of sizable buying by the automobile industry. And no particular areas of strength have developed to take up the slack.

Though the steel production rate continues high, a considerable portion of the output is believed to be going into stocks of semi-finished steel for quick delivery under heavy competitive conditions.

The decline in demand for structurals and heavy plate has finally enabled production to catch up. Warehouses estimate that within two months they will have a well-rounded inventory of these items.

Steel jobbers are believed to have about as large stocks as they ever have had anytime. This year will be the third best in history.

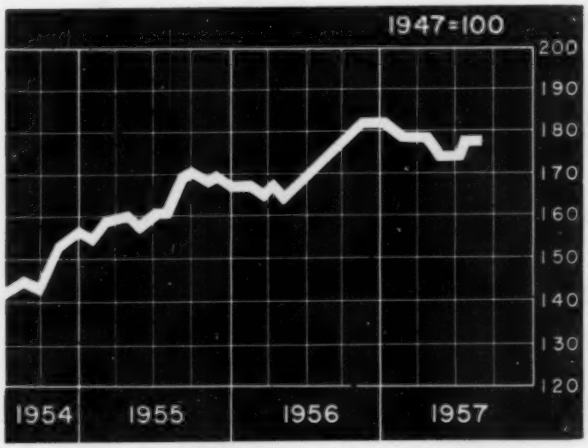
Foundry business off...

Gray iron foundries, many of which have enlarged their facilities the past year or two, are having a tough time getting new business.

The expected fall pickup has not been of the proportions anticipated. Reason: small instead of large volume of automotive orders, and a softening of the situation in machine tools and in machinery building in general.

Some foundries are reported operating on a schedule of three or four days a week.

There is no indication of any decided improvement in demand for steel castings. Bookings, production and backlogs are down considerably from previous levels.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**178**	**178**	**177**	**173**
Machinery	153	152	157	
Electrical Machinery	217	214	211	
Autos	124	118	103	
Other Transportation	366	371	356	
Other Metalworking	145	147	140	

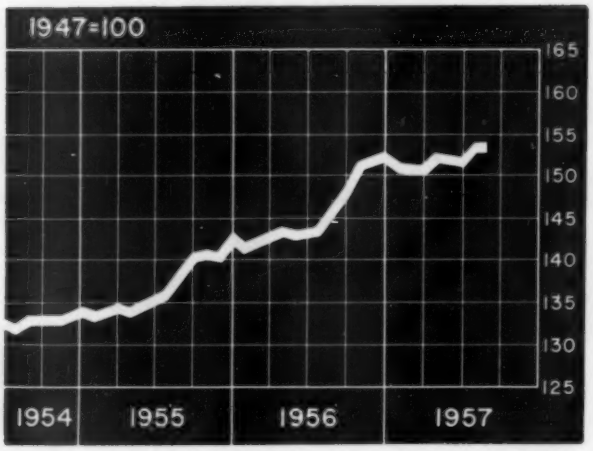
NEWS REPORT

What's ahead: . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**153.6**	**153.3**	**152.7**	**145.5**
Metalworking Machinery	**178.2**	**177.4**		**167.8**
Other Machinery exc. Electrical	**162.7**	**161.4**		**153.3**
Electrical Machinery	**155.7**	**155.6**		**143.7**
Fabricated Metal Products	**144.4**	**144.0**		**138.5**

153.6



1958 will be good, but competitive...

How does 1958 look from here? Best indicator is Gross Natonal Product, sum total of all goods and services produced in the U S. For 1957, GNP is running about $435 billion, and by all indications 1958 will top that by $10 billion.

That's not a spectacular rise. It doesn't indicate a runaway boom in the offing. But it does indicate that the coming year will mark a continuance of the steady rise in U S output.

But 1958 may well go down in business history as a year of intense competition. One reason for this is that a lot of industries have built up more capacity than they need. Since 1950, capacity has increased some 50%, but output has only gone up 38% in the same period.

When manufacturing capacity exceeds production, you can look for tough competition.

Too, rising wages are going to keep on forcing costs up. This squeezes business between the downward-forcing pressure of sales competition and the upward-forcing pressure of rising costs.

This increase in competitive pressure is going to make itself felt in unprecedented expenditures for research and development in the coming year. And in turn, large outlays for R & D will lay the groundwork for a boom in capital goods buying a few years hence, when the R & D bears fruit in the form of new products and methods.

Consumer spending, which accounts for about 66% of Gross National Product, is gathering momentum. If this trend continues into 1958, free spending on the part of the public will go a long way to wipe out some of the present dark spots in the economy—notably those in the automobile and appliance fields.

There is no doubt that the public has the money to buy. It's up to business to make a concerted sales effort to merchandise its goods.

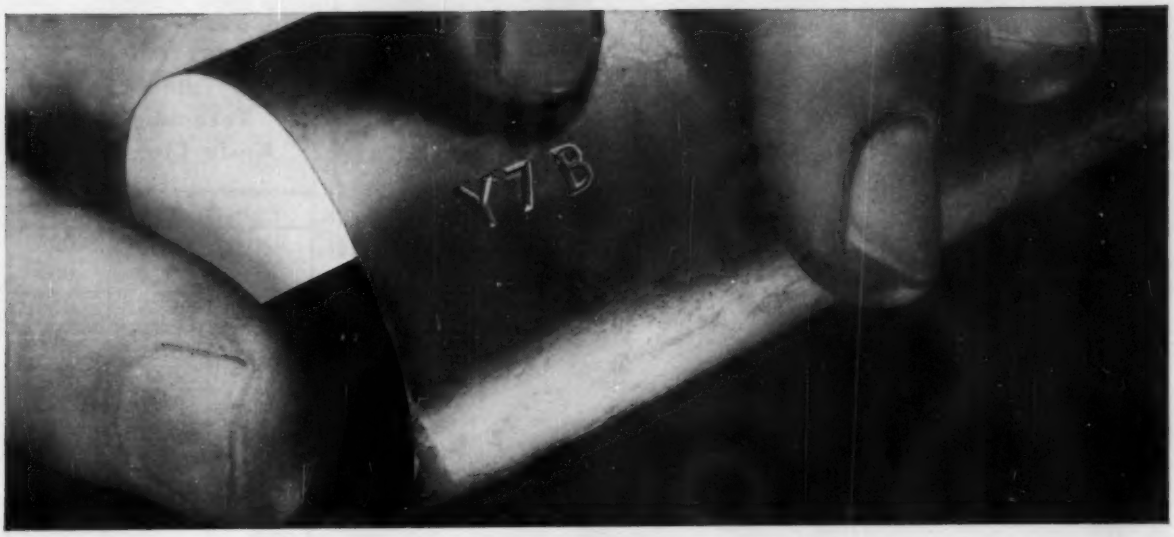
WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	140.6	141.0	146.9
Steel ingot operation (thousands of tons)	2,088	2,115	2,483
Electric power output (million Kilowatt hours)	11,564	11,697	11,342
Production of automobiles and trucks	31,238	62,167	84,113
Engineering construction awards (Eng. News-Record—millions)	$323.9	$333.4	$390.2

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	290	288	335
Vacuum cleaners sales (thousands of units)	207	231	248
Washers sales (thousands of units)	282	254	340
Household electric ranges sales (thousands of units)	59	57	85
Radio production (thousands of units)	1,088	1,024	1,073
Television production (thousands of units)	544	342	553
Gear sales index (1947-49=100)	215.9	263.2	245.4
Foundry equipment new orders index (shipments, 1947-49=100)	187.5	136.2	156.7

* Seasonally adjusted

As positive as a fingerprint—

certified alloys from Ryerson



Alloys from different furnace heats can vary in hardenability and other working characteristics. But with Ryerson alloys you *know* the differences—before you start production. Ryerson alloys are marked with symbols identifying them with the particular heat from which they were rolled. As a Ryerson *extra* you get a dependable special report showing:

1. **Heat analysis.** Not just the chemical range for the type of alloy, but the specific analysis of the heat from which your steel was rolled.
2. **Tested Hardenability.** Not just the average hardenability for the alloy, but the actual Ryerson-tested hardenability for the particular heat . . . as quenched, and at three draw temperatures.

For more information about Ryerson alloys and the Ryerson Certified Alloy Steel plan, call your nearby Ryerson plant.

Principal products: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing, industrial plastics, machinery and tools, etc.

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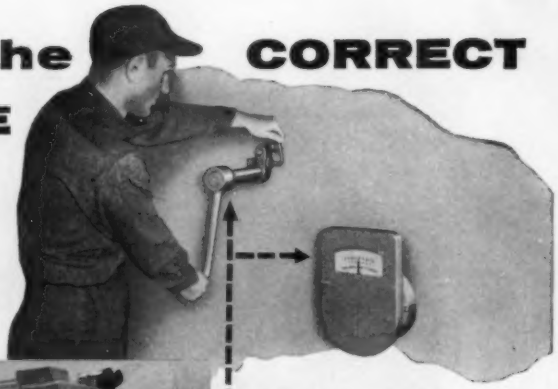
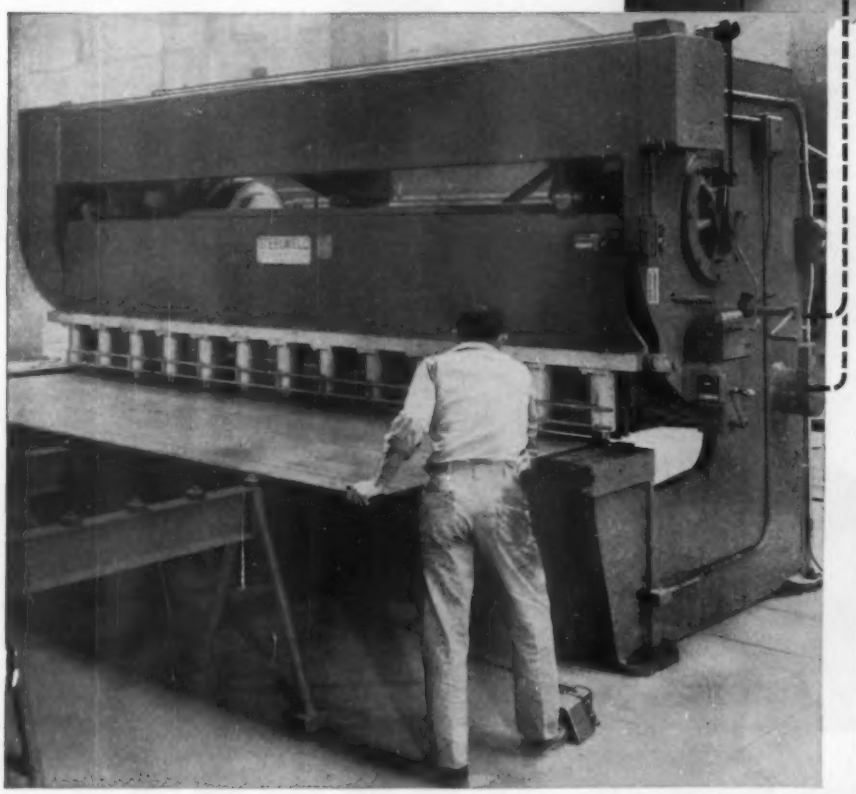
For The *Best Cut*, The CORRECT KNIFE CLEARANCE Must Be Used

Steelweld Shears are available for all thicknesses of steel to 2 inches and for lengths to 30 feet. Electric foot-switch operation, as illustrated, is furnished as standard equipment.





In 10 seconds the knife clearance on Steelweld Shears can be adjusted to suit the thickness of metal being cut. It's merely a matter of turning a hand crank until the gauge pointer is on the proper figure.

Table of Recommended Knife Clearances

Gauge	Steel	Stainless
10	.012	.007
8	.014	.009
3/16	.016	.010
1/4	.021	.014
5/16	.027	.018
3/8	.032	.022
1/2	.043	.029
5/8	.053	
3/4	.064	
7/8	.075	
1	.086	

FOR every plate thickness there is a definite space or clearance between the knives that will produce the best result. When cutting different thicknesses of metal, it is necessary to vary the knife clearance accordingly.

One of the important differences between Steelweld Pivoted-Blade Shears and all others is the ease with which the knife clearance can be adjusted on Steelwelds. With most shears this is a major operation involving the use of measuring devices and requiring a great deal of time. Steelwelds were designed to make this adjustment simple, easy and fast. Hours of work are not required, in fact, the adjustment for any plate thickness can be made in 10 seconds.

Obviously there is no need to shear with some compromise knife clearance setting when you have a Steelweld Shear. You do not have to accept any average cut when with such little effort you can have the best possible cut every time—sharp, straight, accurate with minimum burr. And then, too, remember that knives stay sharp longer when the proper clearance is used.

Easy knife adjustment is only one of many fine features that you will like in Steelweld Shears. For all thicknesses of plate up to 2 inches, for all lengths to 30 feet, you will find Steelwelds have much to offer.

Write for free copy of Catalog No. 2011.
Gives construction and engineering details

STEELWELD

PIVOTED BLADE **SHEARS**

STEELWELD DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 1455 EAST 282 ST. • WICKLIFFE, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Not Just a Passing Fad

Put this one down in your book: automation is not a passing fad that will fade. Interest in it is mounting in Metalworking rather than decreasing.

Almost $3 out of every $10 spent for new equipment by metalworking companies the next year will go for automated machinery.

Automatic loading and unloading of machines is the most common form of automation. It is used by more than half the companies with any automation at all. Transfer devices between machines also are widely employed.

Transfer machines are installed in one out of every four plants with automation. Two out of three plants in the appliance field have them.

Automation is accepted broadly . . .

in metalworking operations other than metal cutting. Presses are loaded and unloaded automatically. And mechanical devices often are used to get the work from one press to another.

Painting is one of the most automated of all metalworking operations. Welding, heat treating and final assembly are being singled out for an increasing amount of automation.

There are sound reasons why automation is growing in Metalworking. It minimizes human effort and thereby reduces direct labor costs. It does the job that skilled workers used to do; and skilled workers are harder and harder to find. It increases the worker's productivity and thus helps to expand capacity without adding a vast amount of new plant. It contributes to a more uniform and better-quality product.

Despite this overwhelming evidence of automation's value and acceptance, as determined by an *American Machinist* survey and spelled out in a Special Report starting on p 165 in this issue, automation cannot be applied successfully everywhere and under all conditions.

For one thing, it requires . . .

in most cases a substantial capital investment. If you expect to use it, you had better be sure that it is going to do for you what you want.

Initial inquiries for a large proportion of new equipment by prospective buyers include use of as much automation as practical. But a close look at the cost and the actual savings often results in a sharp scaling down of the original plans.

American Machinist's survey shows that there is more automation in the big plant today than two years ago, and less in the small shop. This fact makes sense and is the triumph of realism over mere enthusiasm.

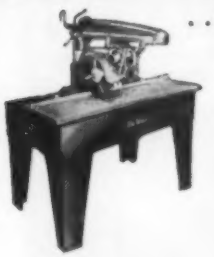
One all-important conclusion . . .

emerges from this survey. Automation is not just a fad. It is growing steadily in response to the need for doing faster and better by machine power what used to be done by hand. But it cannot be applied advantageously in every shop.

Every metalworking management should be constantly conscious of automation's rich benefits if properly used and should be everlastingly searching for practical means of applying it profitably.

Burnham Finney EDITOR

1/3 cost reduction combined with product improvement...by use of Cincinnati Shear and Press Brake



...at **DE WALT INC.**

Lancaster, Penn.

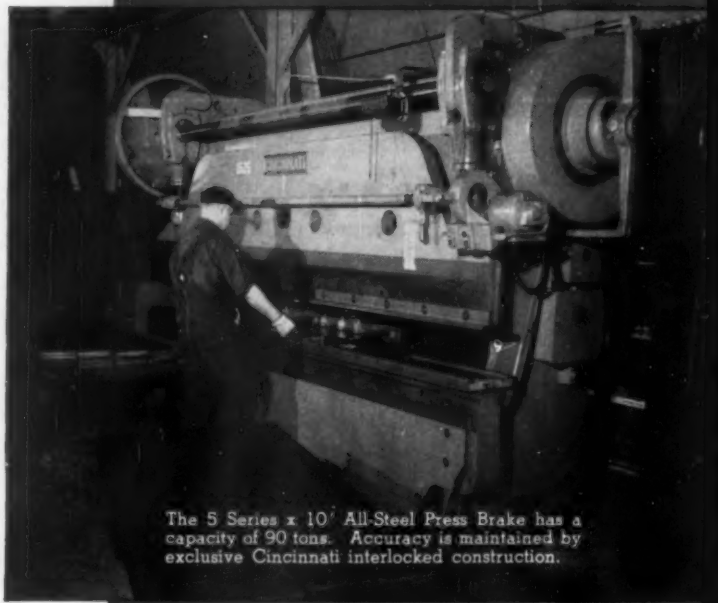
The steel bases of all DeWalt woodworking machinery must be perfectly square, flat and true. Both home shop and heavy duty industrial machines are produced on the Cincinnati Shear and Press Brake shown.

This performance story from DeWalt Inc. tells of improved quality and reduced costs. We quote: "Before purchasing the Cincinnati Shear and Press Brake, we bought formed channels and arc welded them together at the seams. We now buy sheet steel stock—then cut, punch, form, and spot weld the steel bases in our own plant. We have *reduced costs on this operation by over 1/3* on the first run employing these methods, and expect costs to diminish still more as operator familiarity and efficiency increase. In addition to the cost factor, it was previously difficult to maintain precise flatness in the tables. Using the new methods and the Cincinnati machines, we now have no difficulty."

Note the improved design of the Model MB "Power Shop" machine shown at right above. The new, improved cabinet is now produced on the Cincinnati Shear and Press Brake at an *overall cost reduction of 15%*. Previously the cabinet at left was a purchased item.

Write Department **A** for Catalog B-5 and Catalog S-7R and consult our Application Engineering Department about your production problems.

The 1810 Series All-Steel Shear has a capacity of 1/4" x 10' mild steel plate and shears with micrometer accuracy.



The 5 Series x 10' All-Steel Press Brake has a capacity of 90 tons. Accuracy is maintained by exclusive Cincinnati interlocked construction.

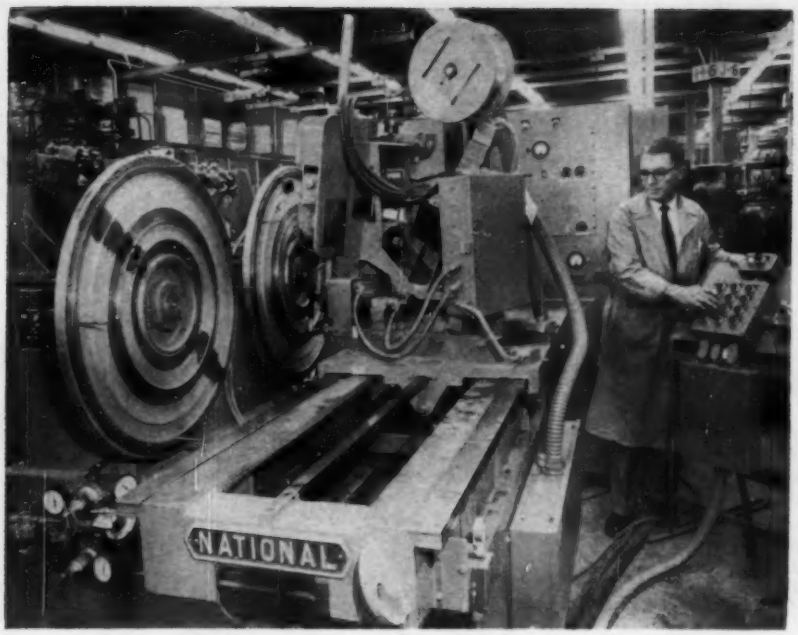
Photos courtesy DeWalt Inc., Lancaster, Pa.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES

American Machinist



Vertical fixtures index accurately . . . from one vane to the next for Tig-welding shroud and vane assemblies. Oscillating movement of arc and filler wire across the end of each vane produces a wiggle that has earned the machine its name —"tiggle wiggle"

High-speed methods weld to aircraft "specs"

GORDON PARKS,
welding engineer,
SOLAR AIRCRAFT CO,
SAN DIEGO, CALIF

Joining aircraft parts formerly required slow, careful manual operations. Now special automatic welding equipment speeds production and improves quality of jet-engine components at Solar Aircraft Co. At the same time, new developments have been worked out for titanium welding, still in the manual stage

About 95% of total production at Solar is devoted to welded fabrication of jet-engine components—usually involving such hard-to-weld metals as titanium, aluminum, or stainless steel. Turbo-jet and turbo-prop engines (which have just about replaced the piston engine in the military market and which are expected to dominate the future commercial market) require about 90% more welding than cast, forged, and machined piston-engine components. The resulting welding problems include greater precision, increased control over quality, and the joining of new and unusual combinations of metals and alloys.

Until recently, the quality of joints required in jet engine components, made it necessary to handle most welding operations manually. However, increased production, as the result of the demand for these engines, made automatic operations essential—with no reduction in the quality of the work performed. To meet this need, Solar has had special equipment designed and built to their own specifications. Among them are a number of electronically controlled welding machines installed at their Des Moines, Iowa facility.

AUTOMATIC WELDING IS PRECISE

Not only are these machines automatic, but they provide a degree of precision not possible with manual welding. Uniformity of welds and consistency of results, for example, are higher—and once a schedule has been established and programmed by electronic control, the machines complete an operation without manual attention.

One of these machines is a tungsten-inert-gas machine, (Tig) which employs a non-consumable tungsten electrode and a flow of argon gas to shield the weld from the detrimental effects of elements in the atmosphere. This unit is employed for welding J57 jet-engine compressor inlet guides. Principal components of the machine are

Assemblies are welded automatically . . . with this new National Mig welder. Power-operated radial arm moves welding head into position at one of four fixtures located around the machine. Built for 360° rotation and 72 in. of longitudinal travel, the arm is sufficiently rigid to prevent vertical variations in torch travel beyond 0.010 in. per foot of carriage travel. Wire can be fed at any speed from 70 to 700 ipm

a radial welding arm which can be swung around for use on either of the two fixtures, controls for both the arm and movable fixtures, and a main, electronically controlled power source.

Used mainly for continuous-line welding, the machine has two revolving jigs in which the part to be welded is placed. After the welding head is indexed, the permanent tungsten-electrode arc is initiated, and the welding cycle begins. Electronic controls feed and regulate wire filler material as it moves into the path of the arc, where it melts and joins with the parent metal. The controls also start the circulation of cooling water through the torch, begin the flow of argon gas, and start the revolving action of the positioner. When the cycle is complete, a smooth, precision weld has been made.

Electronically controlled motors also relieve the welder-operator of any lifting or moving problems. Push-button controls permit lowering or raising the boom, swinging it right or left, or jogging it into perfect alignment with a weld joint. Push-button controls also activate the movable jigs.

A Mig welder (Metallic Inert Gas) operates similarly except that it uses a consumable electrode rather than a permanent tungsten electrode. Metal wire fed through the torch carries the current and strikes the arc between itself and the metal to be welded. The heat created melts the wire, which forms the filler material. Electronic controls are similar to those used with the Tig machine, but in addition they feed the wire through the torch at the same rate that it is consumed in welding. The Mig welding machine is used in the production of J57 diffusers with four electronically controlled constant-speed positioners.

Welding speeds achieved by the Mig process with automatic machines are relative to metal thickness and may go as high as 130 ipm on metals 0.035 in. thick. Metals 0.125 in. thick are welded in the "free state," without mechanical or inert gas backing, at an average speed of 60 ipm. These speeds may be compared with an average manual metallic-arc rate of 4 ipm and a machine Tig welding rate of 16 ipm.

Welded-joint design requires that the strength of the welded joint be such that, when subjected to tensile load, failure will occur in parent metal rather than the weld metal (95,000 PSI or greater for type AISI 410 material welded on the National Mig machine). Every welded joint is given a 100% radiographic inspection and must meet rigid standards. A few examples from Solar's Welding Specification Manual are:

In groove welds, fusion and penetration shall be complete through the joint unless otherwise specified by welding symbols.

In fillet welds, there shall be fusion of the component parts at the root of the joint except where the included angle between pieces joined is less than 80°.

Shallow internal linear indications may be accepted if they meet the following requirements:

The maximum permissible number of linear indications shall be:

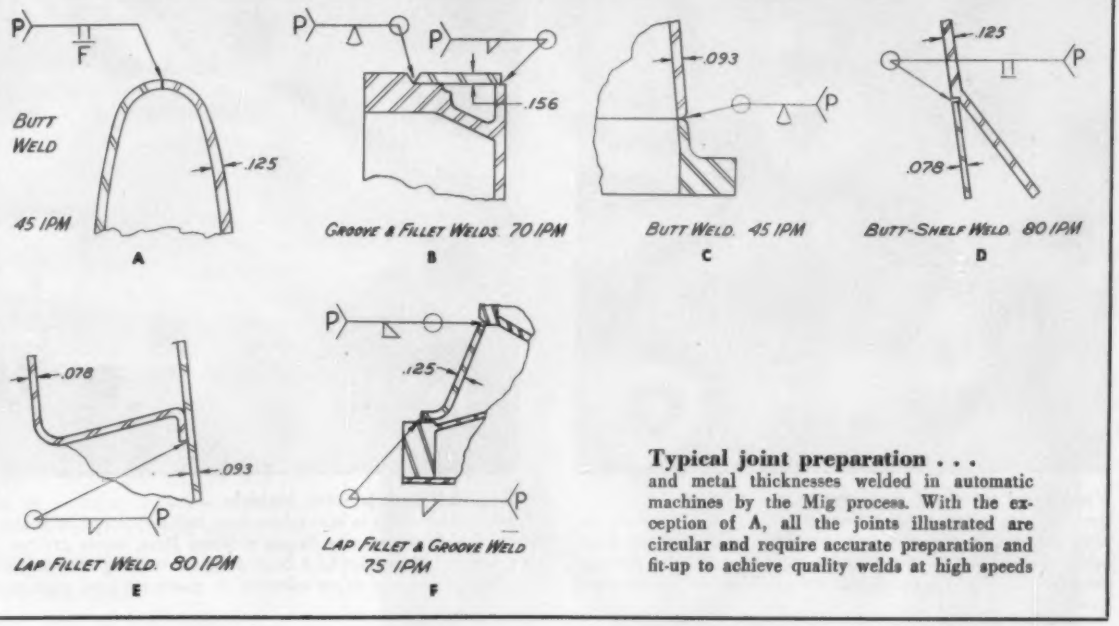
- *One (1) in welds up to 4 in. in total weld length.*
- *Two (2) in welds over 4 in. but not over 8 in. in length.*
- *Three (3) in welds over 8 in. in length.*

The linear indications shall be contained entirely within the fusion zone as indicated on the radiograph.

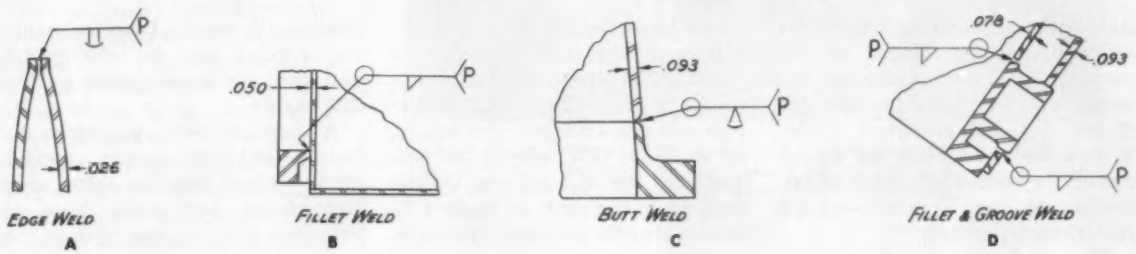
The minimum distance between linear indications shall be 1 in.

The maximum length of any linear indication shall be no greater than one-half the width of the fusion zone as indicated on the radiograph.

"Tiggle Wiggle" is the descriptive name given to a third new



Typical joint preparation . . .
and metal thicknesses welded in automatic machines by the Mig process. With the exception of A, all the joints illustrated are circular and require accurate preparation and fit-up to achieve quality welds at high speeds



Titanium-75A joints are prepared . . .
for manual welding in accordance with the above sketches of joints actually encountered in jet engine components

welding machine—a Tig machine for joining vanes to inner shrouds on J57 vane and shroud assemblies. Two fixtures are employed. One is loaded with a vane and shroud ring assembly while the other is under the welding head. Indexing of the welding head to each vane is precise and is variable to suit the angular locations of vanes in each assembly. Depending upon the compressor stage being welded, vanes may number 108, 142, or some other amount. As the arc and filler material move across the airfoil-shaped ends of the vanes in welding, they oscillate back and forth, producing a smooth, uniform surface. The harmonic motion of the curve thus generated in a horizontal plane produces the appearance of a wiggle—hence the nickname.

The automatic, electronic control of welding current in conjunction with wire-feed speed deceleration permits precise control of the welding cycle. Total time of 300 cycles is required to initiate the welding arc, start the electrode oscillation and forward movement with a delayed wire-feed start, weld, and, in the final phase of the weld cycle, down-slope weld current and decelerate wire feed. Welding time averages approximately 15 min per assembly, and with two welding stations it is possible to produce 20 to 24 welded assemblies per eight-hour shift. When these assemblies were manually welded the average welding operator could produce only about 5 to 6 assemblies per shift. Quality naturally is higher and more consistent, and production cost is materially reduced by the new equipment.

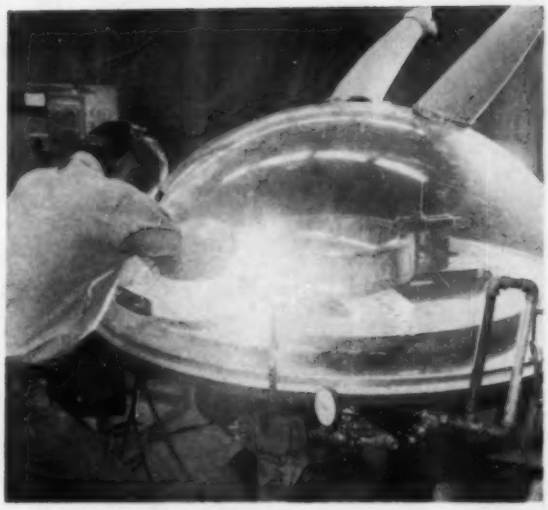
MANUAL WELDING STATIONS

A new Solar-designed welding console consolidates into one package all the equipment needed for manual welding. Previously, manual welders had little or no regulating control over their water and power supply, and gas was piped straight to the work from cylinders or a central supply system. Moving welding locations on the floor was a difficult task.

The new welding consoles, of which 50 have been installed, have changed the whole complexion of the job. A single cabinet contains all the controls and supplies all the facilities for each welding station and includes an electronic control panel, work table, mobile

High-speed methods weld to aircraft "specs" . . .

Packaged welding stations . . .
designed by Solar, expedite manual operations. Fifty such stations are in use, and each one includes a control panel, worktable, mobile light, and tungsten and metallic-arc inert-gas torches. Gages on the panel indicate gas pressure and electrical power



Argon-filled plastic bubble . . .
prevents elements in atmosphere from being absorbed by titanium jet engine components during welding. Here, seams are run on titanium inlet guides in a Solar-designed welding chamber after air is purged and argon admitted to create an inert atmosphere

light, and tungsten and metallic-inert-gas torches. Gages on the control panel provide instant information concerning gas flow (cu ft per hr) and electrical power. With a flip of a switch the weldor can set the station into constant operation or use a remote-control foot-rheostat switch.

The single-unit consoles simplify and expedite location changes, create cleaner working conditions, promote better quality of work, and conserve power and gas. If an operator fails to shut off the gas manually, the gas flow will stop automatically and positively 30 sec after the arc has been broken.

An interesting feature of the new stations is that the power cable to the water-cooled torch runs inside the water tube. The water helps conduct the electricity and also cools the cable, permitting the use of a lighter and more flexible wire.

TITANIUM

Precision workmanship can increase efficiency and develop greater strength in jet engines, but that isn't enough. In the search for light, strong metals to reduce the weight of modern power plants, increasing emphasis has been placed on titanium and aluminum. Although these two metals and their alloys have helped solve a problem for the designers, they present considerable new problems for the weld engineer. The principal undesirable characteristic of titanium, for example, is its affinity for elements in the atmosphere. During welding in the open air molten titanium absorbs nitrogen, hydrogen, and oxygen, producing a weld that is porous and brittle. Ordinarily able to withstand a bend test of 105°, a typical open-air weld in titanium will break at 2° or less.

To meet the demands of the aircraft industry for titanium parts, welding engineers have developed methods of fabricating assemblies in an inert atmosphere. This is accomplished at Solar with the help of special plastic and steel purge chambers. The chambers range in size from a spherical plastic bubble two ft in dia to a square steel chamber seven ft wide.

After titanium parts have been placed inside one of these chambers, the air is exhausted by a vacuum pump, and argon gas is introduced to create an inert atmosphere. The weldor can view the part through the plastic or glass window and has access to the work and the welding equipment by slipping his hands and arms into rubber gloves in the side of the chamber. Presently, titanium welding is being done on inlet guides and front compressor cases for the J57 engine.

A titanium weld exposed to air during welding usually changes from normal metallic color to a light straw, dark straw, blue, or yellowish grey, depending upon the degree of contamination. Prior to welding an assembly, a test weld is made to insure that no air is present in the inert-gas atmosphere. If the sample indicates that the atmosphere is not contaminated with air, a welded coupon is prepared for a bend-ductility test. The bend angle, without cracking, must be 105° around a radius of 12T (12 times the metal thickness). Parent metal must be capable of withstanding 105° bend over a 5 or 6T radius. When test requirements are satisfied, assembly welding is permitted.

Efficient use of the steel chambers for titanium welding requires that they be evacuated to a very low pressure reading. Residual atmosphere is then purged from the chamber, by inert gas (argon), at the continuous rate of 100 cubic feet per hour during the welding operation.

The hemisphere-shaped plastic chambers are not evacuated but are

purged with an inert gas at a rate of 320 cu ft of argon per hour for 30 min. The gas inlets and outlets are then closed and for the first hour 6 cu ft of inert gas flows into the "bubble" through the gas torch. At the end of each hour, the "bubble" is repurged at the rate of 320 cu ft per hour for 4 min. This purge cycle is controlled by three electronic timing circuits and two constant-volume flow meters. The combination of the electronic-controlled gas flow system and the more efficiently shaped plastic bubble has resulted in a 75% gas saving of $142 per 24 hour cycle. In addition, considerably more positive control of welding is possible by visual color control of welded joints, and the transparent bubble permits accurate visual evaluation of weldor skills.

WELDOR TRAINING

New methods and equipment and the challenge of precision work with difficult metals have increased the need and raised the requirements for properly trained, skilled weldors. Wages have been geared to meet this demand, and journeyman weldors at Solar earn approximately $100 for a 40-hour week.

Almost all the weldors at Solar have had formal training to qualify for a welding position. In an effort to supplement this background, Solar conducts in-plant training and testing to provide weldors with the latest information and instruction on welding techniques. Once every six months weldors attend training sessions to re-certify welding proficiency on metals with which they have been working or to receive instruction on new welding procedures.

While in school, under the supervision of a weld engineer, weldors are able to iron out problems they have faced in their day-to-day work. Increased knowledge and additional skills are learned which enable them to fulfill the high standards required by the aircraft industry. In addition to in-plant training, Solar employees are encouraged to take after-hours welding instruction at technical schools. For training successfully completed, Solar pays one-half the cost of tuition.

Take a close look—there really is a difference. Parts are front wing spars for F-101A, and are 5 ft long. Pressed spar at left weighs 42 lb; forging weighs 155 lb and has to be machined down to final weight of 30 lb

PRESSING *(for want of a better name)* makes better aircraft forgings

"No-draft forging," it's sometimes called, but the term "pressing" conveys a more accurate impression. The process consists of placing a trimmed, heated blank in a heated die half, then bringing down the upper die with sufficient pressure to make the metal flow into the required shape. This new technique was discussed by Collins Fuqua, asst project engineer, production design department, McDonnell Aircraft Co, St Louis, at the 13th annual convention of The Magnesium Association in New York City last week.

A slow-acting hydraulic press is required, and it must have up to twice as much capacity as for the same part as a forging. Pressure is inversely proportional to web thickness, so a part with minimum web would require 40 ton/sq in. compared to 20 tons for average forgings. The most outstanding difference between pressing and forging is the draft requirement—5-7° for a forging, but none for a pressing.

Another difference is the minimum thickness of upstanding legs, which can be as little as 0.090 in. for a leg or rib 3 in. high. In a

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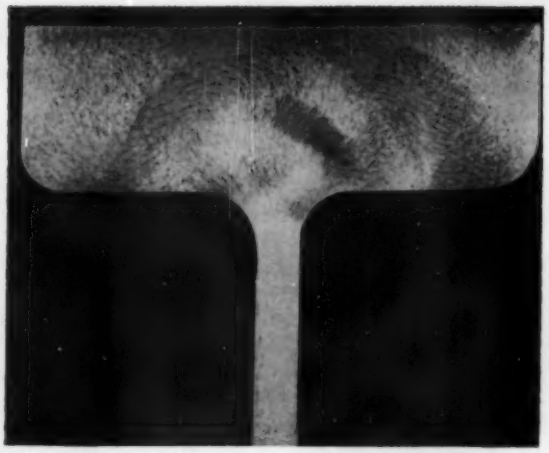
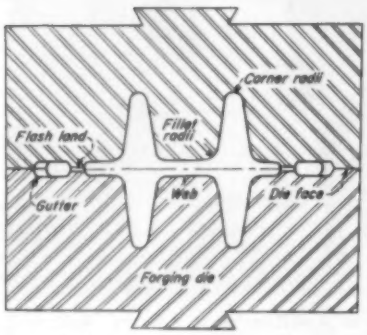
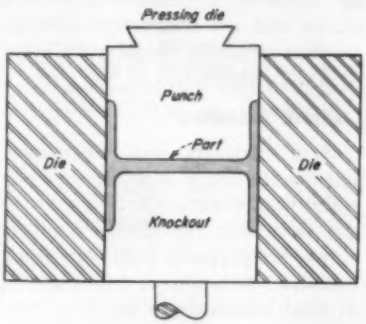




If you had your choice, which would it be? Forging at left was made in die halves hogged out of solid stock, machined to provide flash lands and gutters, and made with 7° draft. Corner radii had to be generous, and forging had to be machined extensively. Pressing at right was formed in built-up die bolted and dowelled together, with punch on ram and separate knockout independently operated. Blanks are cut to match weight of finished part, so there is no excess metal. Draft is zero, web is 0.13 ±0.03 in., legs are 0.09 ±0.015 in., and length tolerance for 12 in. is ±0.025 in. Note grain structure, which shows flow from web to leg. No machining is necessary



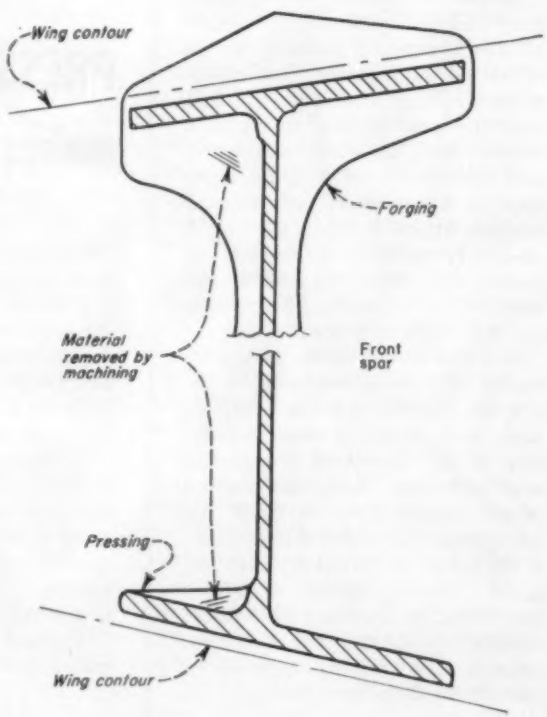
forging the leg would have to be at least 0.5 in. thick. Of course tolerances are closer on pressings than on forgings.

MATERIALS

Most experience so far has been with aluminum, particularly with 2014 and 7075 alloys. Both of these have been forged as well as pressed, and requirements for a material suitable for pressing appear to be the same as for a forging material. Alloy 7079 has been forged but not pressed because its only advantage over 7075 is in response to heat-treatment in thick sections; pressings do not normally have thick sections.

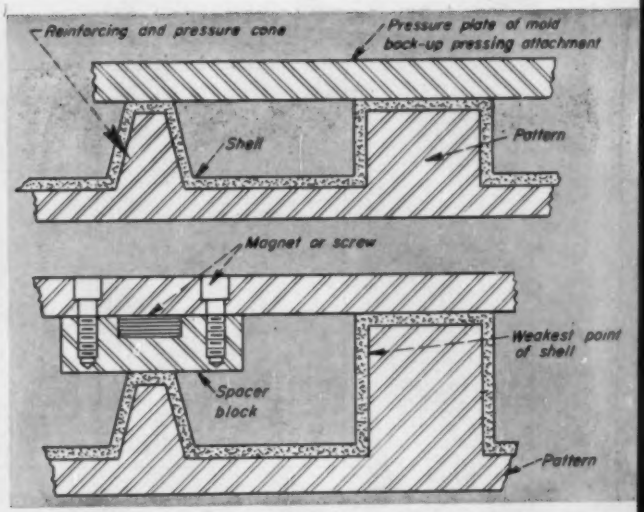
Magnesium alloy ZK60A has been pressed in production, and alloy HK31XA has been pressed experimentally. This is exactly the same status as in forging.

McDonnell has used over 200 pressings in airframe construction, and has specified as many as 60 on a single airframe model. The current trend, judging by inquiries from forging companies interested in the results, is to increase the use of pressings.



Inboard spar spans full wing thickness and carries the main bending load. Top section shows how forging has to be machined away to fit; bottom section is of pressing, where web is 0.15 in. thick and leg is 5.5 ft long and 0.29 in. thick

Finished shell mold is being removed from thermodie, prior to cracking apart cope (left) and drag (right). Tooling is built up with bronze details on alloy iron plate. Note pins



Deep holes in shell molds are sized accurately by backing them up positively. Clamping fixtures prevent such extended sections from warping or moving

How precision toolmaking affects shell-molding success

Patterns and core boxes for shell molding—they are called thermodies—operate at temperatures near 500 F and perform a precise heat-transfer function in addition to determining the dimensions of molds, cores, and castings. Tooling for shell molding is therefore more properly a tool-and-die problem than one for the average pattern shop. Here are the reasons why shell-molding tooling is difficult and how it controls results in the product. Material is by the author of "How Shell-Molded Castings Affect Shop Practice"—(*AM*—Oct 10 '55 p135).

OTTO W WINTER, manager, Shell Mold Div, Beardsley & Piper, div of PETTIBONE MULLIKEN CORP, CHICAGO

A shell mold is a movable, expanding, combustible, temporary form into which molten metal is poured to produce a close-tolerance casting on a high-production basis. Pouring temperatures range from 1000 to 3000 F, depending on the metal, and the phenol-formaldehyde thermosetting resin that bonds the sand together has a flash point at around 730 F, so it starts burning immediately. Only the poor heat conductivity of the sand, which makes up 93-99% of the shell mold, prevents instant combustion and complete collapse of the mold.

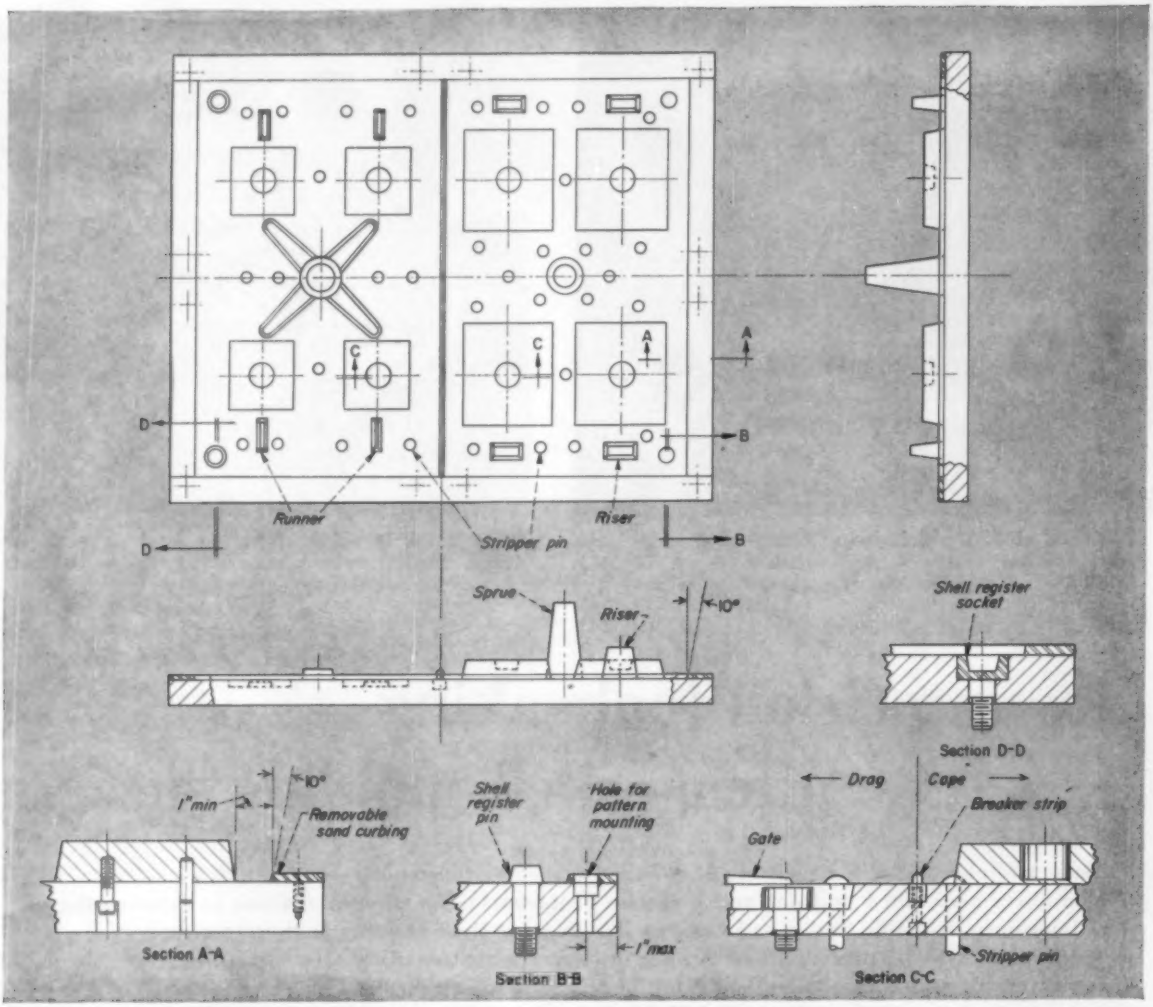
Under these conditions, it is no wonder that simple shrink rules cannot be applied to the tooling, and that normal casting latitudes cannot be allowed. Some pattern shops are hiring tool and die makers and are acquiring toolroom equipment to handle the problem. They have been forced to do so by expensive failures when attempting to follow conventional pattern-shop practices.

Actually, there is enough accumulated knowledge and know-how to permit pre-engineering and detailed designing of shell-mold tooling. Cut-and-try methods are expensive and not really necessary. It is the toolmaking problem that is often apparent when a pattern shop attempts to get into shell molding. In fact, a number of fabricating shops are thinking of integrating shell-mold lines closely with their machining lines, bringing the casting line into the production shop where it can receive full toolmaking attention.

TOOL-DESIGN FACTORS

Thermodies for shell molding must be designed with these factors in mind because they strongly affect results:

1. *Expansion of the tooling* as it heats to operating temperature—450-500 F—which must be the same at each investment cycle.
2. *Resin shrinkage* while molds and core are curing. This varies with sand and resin makeup, and may be severe at unconfined dimensions.
3. *Mold expansion* when metal is poured. Expansion tapers off at



Typical shell-mold pattern includes breaker strip, section C-C, which simplifies breaking cope and drag apart. Material is usually normalized cast iron or steel

about 1190 F, but can be serious up to this point. Expansion is controlled by mold layout, gating, pouring speed, timing, and volume of metal cast.

4. Mold spreading and swelling, caused by pressure of the molten metal inside the mold. If mold halves are adhesively bonded together no backup is applied. Mold strength can be raised by increasing mold thickness, increasing resin content, or by providing a dense hard-rammed mold, or any combination of these improvements. But thicker molds take longer to produce and use more material, while resin adds sharply to costs.

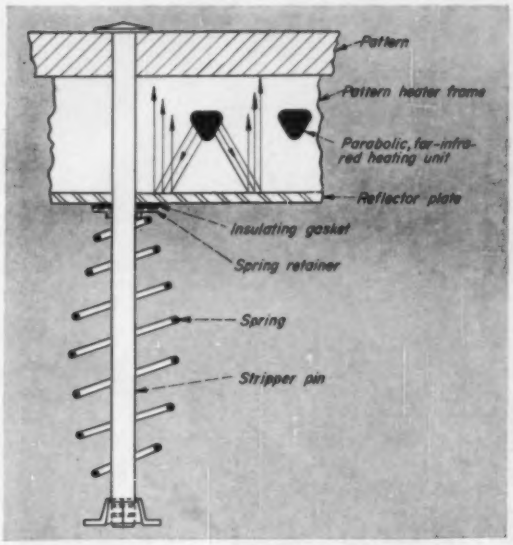
Conventional dump boxes with their side-slide action produce soft sand "blobs" that do not support the pattern fully, and they are the greatest single deterrent to good shell molding.

Parting-line error, often 0.015-0.020-in. with dry powdered resin adhesive, can be reduced to 0.007-0.010 in. with aqueous resin. But swelling in the casting cavities can only be countered in tool design with tricky engineering. A better approach is to back the mold adequately. Steel shot, vibrated into place, works well because of its high specific gravity, good flow, and high thermal conductivity (which helps slow up mold disintegration). Gravel and sand also can be applied with lesser results.

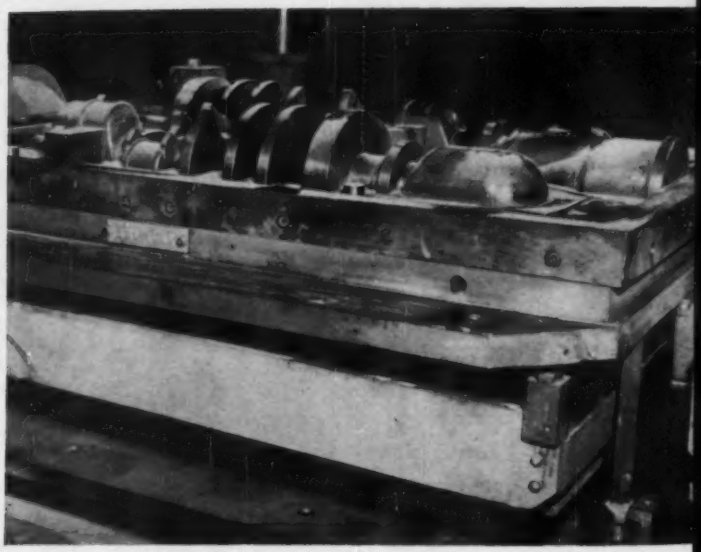
Automotive crankshafts weighing close to 60 lb are being poured in hard-rammed, steel-shot-backed molds only ⅜ in. thick; two to a mold measuring 24 x 42 in. Only 0.030-in. machining stock is left on the castings, and all turning operations are eliminated.

Another method of backing the mold is to provide flat conical support points on the pattern, to which may be applied weights or clamps. These are pressed while the invested shell is still soft before curing, bringing them accurately to their proper levels, which insures uniform results from clamping. With this practice, however, the sides of the mold cavities get no support.

An alternate solution is mold-blowing into a cavity between two hot patterns, waffle-iron style, or through a cold contour blow plate with subesquent furnace cure. Either method costs more for tooling, but allows clamping between two



Stripper pins are equipped with barrel springs that have deep stroke and no coil interference. Bottom retainer and lock are automotive types. Heat from far-infrared units reflects from plate and soaks into pattern, painted black



High, thin pattern projections may be heated by supplementary infrared lamps in addition to thermostatically controlled main heater arrangement. Another way to add heat is with small pencil heater elements deeply inserted into pattern from below

contour plates for pouring. However, blowing equipment lacks flexibility and increases costs. Hard ramming is a better answer.

5. *Metal shrinkage,* as in conventional sand molds, but with the additional effects caused by mold spreading and swelling. Section thicknesses and mass have their usual effects.

6 *Mold collapse,* which starts when the mold temperature reaches about 730 F, and goes on simultaneously as the metal cools and shrinks. The mold is, of course, destroyed as the metal is poured, and only the overlap in timing between metal cooling and the last remaining mold strength, just before destruction, provides the cooling metal with enough shape to form it into a cast product with dimensions as planned. Mold strength should be high to prevent the mold from falling apart and burning too rapidly. Temperature and nature of the mold backup are also important, and heat dissipation through the backup should be high—as with steel shot. Mold backup must be returned to original, planned temperature each time before a new casting is made. Thermal conductivity of the sand has an effect, too; zirconite sands are increasing in use over silica sands because conductivity is about double.

7. *Warping and distortion,* not all of which may be caused by uneven cooling because of different section thicknesses. Mold expansion and its relation to gating is a factor, and must be countered by correcting thermodie dimensions after trial runs. Some dimensions must be "faked," as, for example, a round cup shape such as a brake drum or motor end frame, which might have to be cast in a mold that is considerably out of round in a certain amount and direction.

8. *Pouring practice,* which includes elements such as height and speed of pouring, metal temperature, position of mold, and so on. Gating can help to compensate for pouring errors, but pouring technique should be standardized and the same every time.

GATING

Shell molds require different gating than conventional molds because resistance to metal flow is much less—perhaps ⅛ as much. The rush of hot metal into the relatively frail shell can cause trouble, so the gating system must choke the flow. In addition, the metal solidifies more slowly because the mold passes heat more slowly, so sprues, gates, and runners may be much smaller because the metal does not have to be dumped into the mold as rapidly. This helps produce the high metal yield characteristic of shell molds and allows packing a number of casting cavities into a given mold area, providing proper arrangement, gating, and assembly practices are followed.

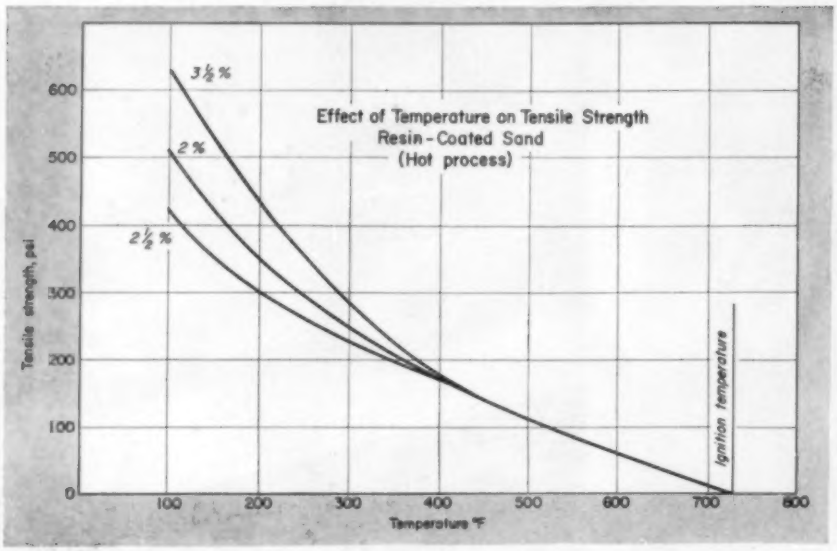
Actually, a shell mold is not weak, but it is often built with walls as thin as ¼ in. The real strength of the plastic-impregnated sand may be utilized by building in saw-tooth slag traps and choke sections in the sprue.

Pouring may be done horizontally or vertically. Vertical pouring is preferred when the mold is backed up, although vertical pouring can be applied if the mold is only adhesively bonded, provided the increased metal pressure is taken into consideration.

Vertical gates usually provide more effective feeding heads, and the normally expected loss of yield can be countered by using a small sprue and separate pouring cup. Most often large and heavy castings are gated vertically (with backup), while light work can be handled by bonded or weighted horizontal shells.

FITTING AND ASSEMBLY

Shell-mold alignment is important if the product is to be made



Mold loses strength as temperature goes up. Note unimportant strength differences for different resin contents except at low temperatures

accurately. Common practice has been to form tapered plugs and sockets, but cores and core prints have become more general final locators as shell molding has increased in application; plugs and sockets can be limited to helping guide cope and drag together, but doing no final locating.

Core prints must be accurately fitted because a shell mold is rigid and will not give to accommodate warped or oversize cores. If the prints are oversize, leakage will result, though baffle grooves will help a bit. Tapered core prints help assembly when standup cores are fitted, and also facilitate assembly of kiss cores that socket into the mold or each other.

STRIPPING

Finishes on the thermodie must be good—in the region of 16 mu in. if possible. The ultimate casting can never have a finish better than that on the thermodie. Another reason for good finish is the tendency for the plastic resin to melt during investment and to flow into minute imperfections in the thermodie, if any. The resin clings, hardens, and presents resistance to stripping.

A properly made thermodie can produce castings with zero draft and with as much as 6 in. of draw, but ½° draft is usual. More than this requires too much extra machining.

Back draft cannot be allowed, and even slight surface roughness will cause sticking during stripping, sometimes even if minor scratches and gouges are parallel to the direction of stripping action. Hand-polishing strokes should be parallel to the direction of draw.

The greater the stripping area the better, and mushroom-head pins may be applied to increase stripping-pin area without increasing mold stress and distortion. Pins should be close to the draw surface if the draw is difficult, and should always be located at the bottoms of holes and pockets. Straight flush pins should be prevented from falling out by tying them in with a guided spring-return plate. Push-pull plates may be incorporated, but they are less flexible and more costly. On spring-return plates, the main trouble to avoid is overheating the springs.

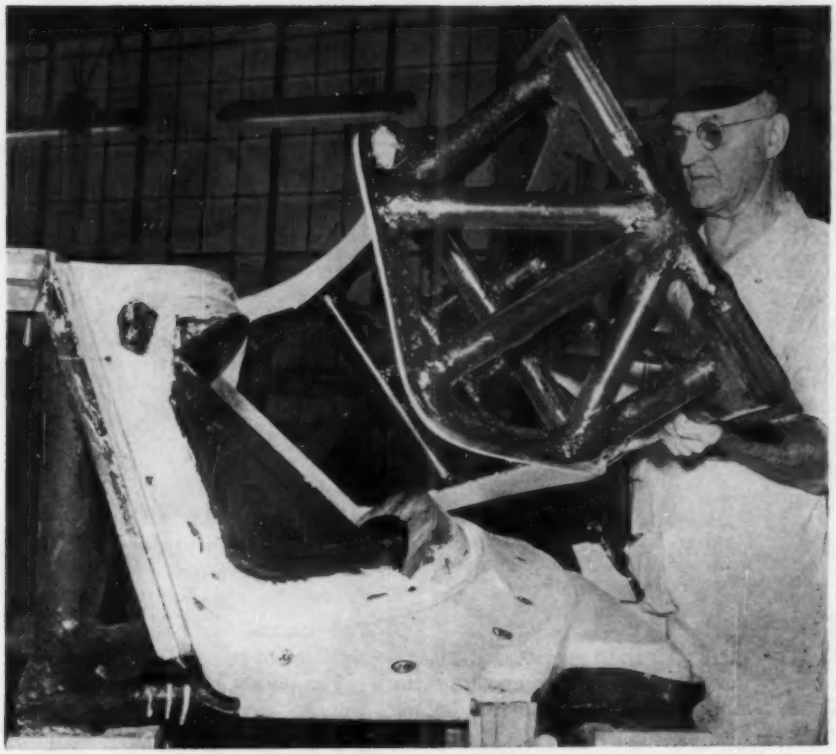
Clearance for mushroom-pin stems can be 1/32 in., and light springs may be used. Clearance for flush pins, however, should not exceed 0.010 in. on the dia. Flush and mushroom pins may be used together in groups. Pin lengths must be accurate, and the stripper plate must contact the pin ends precisely and raise them all in unison. Precision guides are essential for this purpose; otherwise the shells will be warped.

Wear and life of the thermodie depends on a number of factors, including surface finish, draft, material, and treatment and cleaning in and out of service. Normal wear should be around 0.0001 in. for 100,000 ejections for alloy cast iron, 0.0003 in. for copper, 0.003 to 0.004 in. for aluminum. Walnut-shell blasting is a good method for periodically cleaning off release-agent buildup. Excessive wear opposite blowholes can be reduced by enlarging the blowholes, which reduces the velocity of the sand.

THERMAL DESIGN

A thermodie is really a heat-transfer tool, and must be engineered properly. Thermodie temperature determines the thickness of mold and core walls in dump-out molds, and heat from the thermodie is at least a primary factor in shell curing on the vital working faces of cores and molds. It also furnishes the entire curing heat in cases of closed-box and waffle-iron molds and in core blowing. Thus, the temperature and ability to store heat exhibited by the thermodie are of utmost importance in preventing mold collapse.

In turn, the point at which the mold and core will collapse determines casting size and shape as well as surface quality. The thermodie must also have the ability to recover heat in the time between investments. Thermodies may be heated externally or heated by internal electrical units. Tooling cost is reduced if the shell-molding machine includes a heating arrangement, such as electric or gas elements, which heats the pattern as it is carried in a frame or plate.



Reinforced-plastic gage for checking windshield opening is easily handled despite its size. Gaging surface is built up of laminations applied directly to wood-and-plastic copy of windshield area, and is stiffened by plastic tubing

Plastic tools cut costs for Studebaker

Lightweight reinforced-plastic tools can be made in a fraction of the time needed to make similar steel tools—and at less cost. Epoxy resins and glass fiber tape make these tools light without sacrificing durability or accuracy

As told to
BEN C BROSHEER, Associate Editor
By GROVER C BARNES,
Foreman of Patternmakers, Body Division,
STUDEBAKER-PACKARD CORPORATION

Reinforced-plastic tools are responsible for major savings in Studebaker-Packard's South Bend Body shops. Without sacrificing any accuracy, these tooling techniques are making possible the construction of many lightweight inspection and tool setting gages, locating fixtures, drilling jigs, and spotting models for the economic production of auto and truck bodies.

Since the first one was tested early in 1953, the Body Div's patternmakers have built over 250 such reinforced-plastic tools.

These tools can be made in one of two ways, depending upon their application. If the tool must mate with a particular surface or part, it can be built up directly against the mockup or sample part. Where the tool surface must duplicate the exact shape of the mockup or part, it is made up of laminations applied on plaster forms cast against these models.

When plaster molds are needed, Studebaker-Packard uses U S Gypsum's Hydrocal B-11 cement. This high-strength, low-expansion cement has a high degree of plasticity before setting, a gradual setting action, and a minimum compressive strength of 3750 psi when set and dried—features which make it very suitable for modeling prior to construction of the reinforced-plastic tools.

Cement powder is added to warm water until the water will not absorb any more powder. The warm water helps to reduce even further the low setting expansion, which averages 0.0004 to 0.0005 in.

Plastic tools cut costs for Studebaker . . .

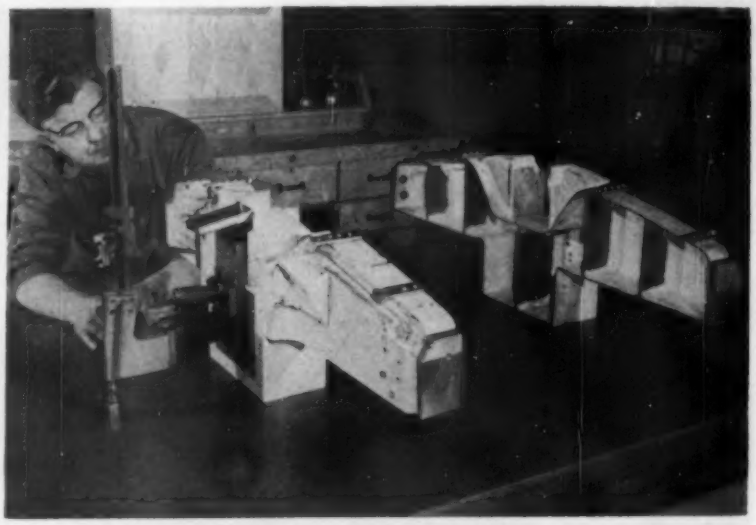
per in. of thickness. Normal consistency for a pourable slurry is 48 to 50 parts of water to 100 parts of cement powder, by weight. Slurry is brushed onto the previously waxed and polished surface of the model until a ⅛ to ¼-in.-thick layer is built up. When this coat has set so that it is capable of supporting strands of hemp fiber, loose handfuls of hemp fiber are dipped into the slurry and laminated onto the plaster coating. The skin is built up to a thickness of 1½ to 2 in.—this provides maximum stability, and any additional strength that is required will be supplied by the wood base.

The previously prepared wood base is inverted over the model, and the plaster-soaked hemp fiber is built up around the support legs to attach the base to the plaster skin. Such a mold requires 1 to 2 weeks to dry and cure thoroughly, but the surface generally is hard enough in 2 or 3 days to permit it to be shellacked and used to make the reinforced-plastic tool.

BUILDING THE TOOL

Plaster or wood models whose surfaces have been sealed with shellac, and reinforced-plastic models made with epoxy resin must be carefully prepared before the laminating step. The mating surface is waxed and polished; a coat of Ren parting coat is brushed or sprayed on; and the Ren epoxy-resin surface coat, which will form the face of the tool, is brushed on.

For work on steel models or sample parts (which have been supported to resist deformation), the parting coat is not necessary. The surface is cleaned thoroughly with a suitable solvent, then waxed and polished before application of

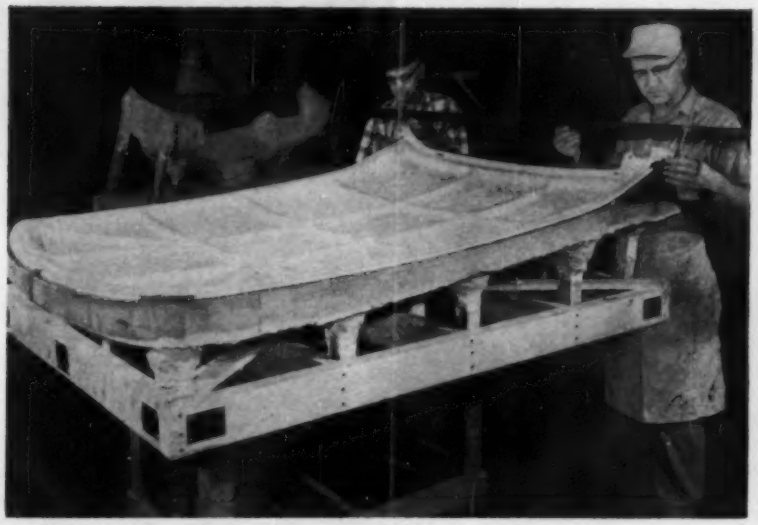


Gaging fixtures for hood reinforcement use glass-reinforced plastic, steel, and Masonite stiffeners. One unit goes to vendor for master checking gage; other, to S-P receiving inspection department

Building a drill jig...

Drilling the master body assembly is first step in construction of jig for quarter panel trim holes. Fore-and-aft locations must be held within 0.010 in., vertical locations within 0.005 in. Surface is cleaned carefully before being waxed

Wax fillet strips, applied with heated fillet tool, are spaced evenly along each row of bushing holes. Vertical sections are shimmed with sheet wax so laminations in these areas will bridge over steel when jig is used



Plaster mating model, cast to wood mock-up model and reinforced with wood frame, is used to form duplicate of roof panel. Split plastic tubes stiffen the plaster model

the epoxy resin surface coat.

Ren epoxy laminating resin and 0.013-in.-thick glass-fiber cloth and/or tape are used to build up the tool face. First, the model surface is coated with resin, then the reinforcing cloth is applied and soaked thoroughly with resin. One lamination is completed before the next layer is started.

For most tools, a total of 8 to 10 laminations is sufficient to develop a strong, hard, stable, and wear-resistant face. Because heat is generated as the resin sets and dries, laminating should be stopped after 4 or 5 layers to allow the stack to cool. Large tools may require additional layers, but usually they can be strengthened by attaching tubular stiffeners back of the laminated faces.

Studebaker - Packard stiffens their tools with glass-fiber-reinforced Ren epoxy plastic tubes which are available in a variety of sizes. both round and square, and can be cut and shaped to follow along even intricate contoured surfaces if necessary.

Tubes and other types of reinforcements, as well as gage surfaces and wear-resistant pads, can be cemented to these plastic tools with putty made by mixing glass fibers (approximately 10% glass flock and 90% glass fiber makes good mixture) with Ren epoxy tooling resin. Completed joints often can be smoothed by covering with glass-fiber cloth or tape saturated with tooling resin.

Completed reinforced - plastic tools can be painted with almost any enamel for identification or to improve their appearance, although painting is not necessary to protect them against shop liquids or abuse, once the resins have dried.

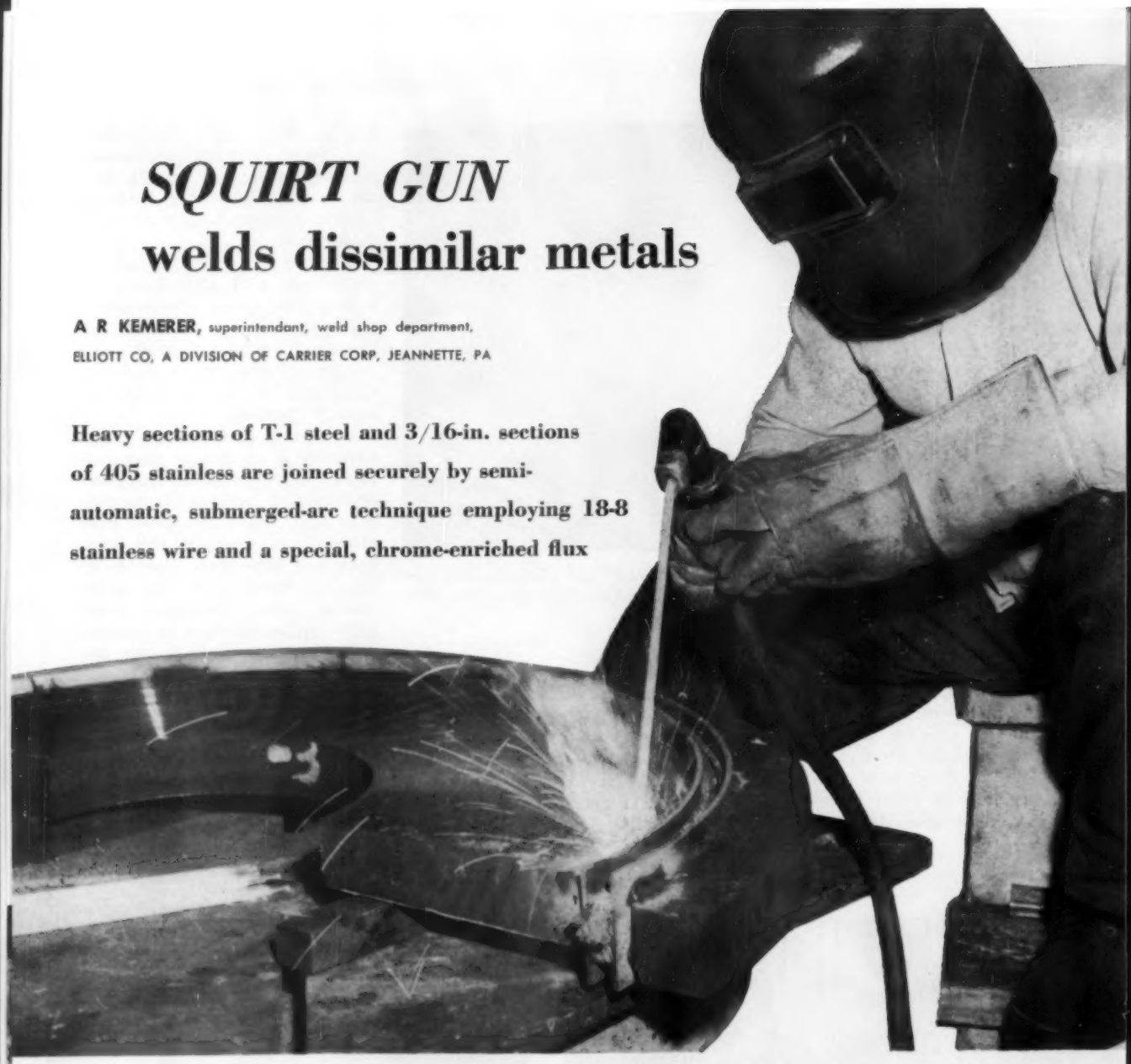
Epoxy-resin surface coat is allowed to dry ½ hr. Successive laminations of 0.013-in.-thick glass fiber tape or cloth form the tool. Immediately before each lamination, surface is coated with Ren laminating epoxy resin

Finished jig includes two locating pins which locate jig on quarter panel after a hole has been drilled at each end. Drilling is done while bodies are still on assembly jigs. Separate jigs are made for each side of car and for each body style

SQUIRT GUN welds dissimilar metals

A R KEMERER, superintendant, weld shop department,
ELLIOTT CO, A DIVISION OF CARRIER CORP, JEANNETTE, PA

Heavy sections of T-1 steel and 3/16-in. sections of 405 stainless are joined securely by semi-automatic, submerged-arc technique employing 18-8 stainless wire and a special, chrome-enriched flux



Inner ring is welded to nozzle ring . . .
of steam turbine diaphragm assembly. First pass is made with 307 stainless electrode. Asbestos packing protects nozzle vanes from spatter

In the assembly of nozzle rings to inner and outer rims of diaphragms for multi-stage steam turbines, semi-automatic Squirt welding with 18-8 stainless steel wire and a special chromium-rich, granular, agglomerated flux has proved to be an effective and economical method of welding dissimilar steels. The Elliott Co is using the technique on a wide range of diaphragms from 30 to 54 in., calling for material thicknesses ranging from 3/16 in. to 3¼ in.

The diaphragm, fabricated in semicircular halves, comprises three elements: the heavy inner ring, the nozzle ring assembly, and the rim, or outer ring. The constraining heavy rings have been made of different steels — chrome molybdenum, copper-bearing, and more recently T-1, a relatively new low-carbon, quenched and tempered constructional alloy plate steel. It shows minimum tensile strength of 105,000 psi and is readily weldable.

The nozzle ring assembly, sandwiched between these two heavy rings, is made up of the curved nozzle vanes and the two concentric shroud bands that hold them in position.

The vanes and the bands are both of type 405 stainless steel, a ferritic analysis with 0.08% carbon, 11.5 to 13.5% chromium, and 0.10 to 0.30% aluminum. The bands are 3/16 in. thick, and the vanes are precision forgings, curved suitably to redirect steam from one stage to the next.

In the subassembly of the nozzle ring, the vanes are positioned

in the shroud bands by means of grooves machined on the opposing inner faces of the bands and conforming to the curvature and varying thickness of the vanes. Then they are tacked and securely welded in place with a 307 stainless electrode.

WELDING THE DIAPHRAGM ASSEMBLY

Before welding, J-grooves are machined to a depth of ½ in. on either side of the OD of the inner ring where it meets the nozzle ring, for good weld penetration. The outer ring carries a simple fillet weld on one side and is grooved on the other side for better penetration.

Manual welding is employed for the first pass in all grooves, with ⅛-in.-dia AWS class E-307, lime-coated stainless steel rod being specified. Finish passes are made with a Lincoln Electric ML-2 semi-automatic welding gun which feeds 3/32-in.-dia 18-8 stainless steel wire to the arc, enveloping it with Lincoln's new ST-100 granular flux. The latter, containing ferro-chrome and other additions, prevents loss of chromium across the arc during metal deposition. The resulting weld is virtually self-cleaning and has a uniform smooth appearance.

The submerged-arc gun is guided manually around the joint while the assembly is rotated in a flat position by a turntable which provides a choice of travel speeds —in practice, 16 to 22 inches per min, depending on the diaphragm being welded. Sectioning of completed welds has revealed a minimum of distortion and complete absence of gas pockets or weld cracks.

The as-welded diaphragm is made slightly larger than a true semicircle to allow for a full run-out on the weld and to provide ample stock for subsequent machining to accurate size. All surfaces of the assembly are machined, including the edges of the shroud bands and the welds, but not the precision-forged vanes.

In the turbine, the mating halves are held together securely by locking lips and dowel pins on the contact faces and by a heavy casing which is bolted around them.

Squirt gun finishes the job . . .
with 18-8 stainless wire and ST-100 flux. The weldor holds the gun stationary, and a turntable rotates the workpiece past him

Welded and ready for machining . . .
this assembly is oversize on all dimensions and extends more than a full semicircle to provide adequate machining stock

Completed diaphragm half . . .
has been machined all over, and locking lips have been installed. Next it will be placed in a steam turbine

Round Table...

Foreman — But Not Foremost

"Some of this automated equipment we're putting in is giving me a bad time, Al. I used to be able to tear down and rebuild any equipment in the shop, but now I have to call in a specialist to handle those new presses we're trying out. I have a feeling that a lot of my men are going to lose respect for my judgment."

"I don't see why, Ed. Can't you take some of those instruction manuals and bone up on the new equipment? Besides, nobody can expect you to know everything about that equipment. Why, do you realize that there isn't a television or radio man in town that can touch our new numerically controlled milling machine?"

"Yeah, and I've used that little point once or twice already, but I'm not sure how convincing it is. Most of my men are used to calling on me to do everything from setup to complete overhaul, and that's impossible now. I can learn a little about the equipment, but what the hell do I know about electronics and numerical control?"

"So what? They don't expect you to be an electrical engineer. You still run the department, and I haven't heard anybody complain that you don't still keep them hopping. The important thing is that you know just as much about it as any of them do."

"It might not always be that way, Al. Some young fellow might come in with a good understanding of electronics and show me up. Then I'd really take a beating."

"I don't think you have to, Ed. It seems to me that a foreman should earn his pay more on how he handles his men and gets the work out than on how much he knows about the equipment."

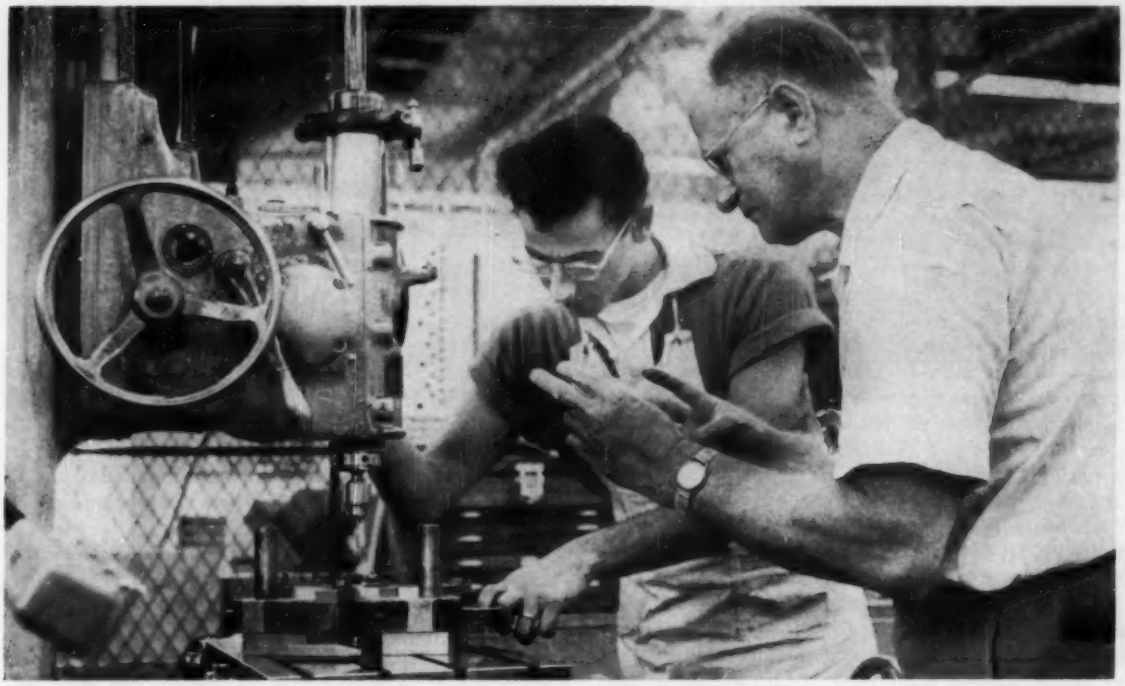
"Listen, Al; I've heard you make several remarks about a certain foreman we used to have here who didn't know a wrench from a die stretcher. That just proves my point."

"There's a difference, Ed. You know you're up on mechanics enough to keep ahead of your men; and you can't do any presswork at all without at least some mechanics. But the specialized stuff—the electronics—is new to everyone. I think you ought to forget it."

"It looks like foremen are going to drift more and more toward simple administration."

"What makes you think administration is simple, Ed?"

***ARE FOREMEN** headed toward a time when they will know less and less about the equipment they work with? Must they work more and more with people, not machines? Your opinions may help others. Discussions of earlier topics start on page 228.*



- **Do you think that apprentice training methods created during the horse-and-buggy era are adequate for this age of automation?**
- **Are you a member of the "let somebody else train 'em, we'll pirate 'em" school of apprentice training?**
- **Do you *really* think you can't turn out a journeyman diemaker able to meet your shop's needs in less than 8000 hours?**

If your "yes" answers outweigh the "no's," you're headed for some major stumbling blocks in this era of specialization. If the "nay's" have it, you're on the right track. Either way, here are some eye-opening ideas on how to . . .

Train Diemakers to Match Your Specs

At 4000 Hours, a Journeyman Geared to Your Special Needs

ROBERT W BURGESS, chief engineer, GREIST MFG CO, NEW HAVEN, CONN

Within 10 years, half of America's skilled diemakers will be lost to industry—not from any major disaster or depression, but from natural attrition, things like promotions, retirement and deaths. Who will take their places?

Let's look at facts. Today the ratio is 10 journeymen to one apprentice The average diemaker apprentice program takes 8000 hours, or four years. That means that by 1967, 75% of today's skilled diemakers won't be replaced—unless something is done right now to re-gear outmoded training methods to meet the demands of the "Pushbutton Age," which certainly will be with us by that time.

The answer? Create a diemaker able to fulfil the specialized needs of your own plant after the first 4000 hours of his training. Pay him journeymen's wages at that point—*then* let him go on to become a diemaker who is "all things to all men" by completing his 8000-or-so hour apprenticeship on the job. Let your jig and fixture trainee learn to build a compound die at a later point in his training, but first let him learn jig and fixture making. That, in essence, is the Greist Plan.

Idea is that after 4000 hours training in your plant's special phases of diemaking, you pay him Class "C" journeyman's wages—even though by

State Apprentice Bureau standards he still is not a qualified journeyman. To achieve a State Certificate, the apprentice then continues his training on the job the requisite number of additional hours.

The indenture, or apprentice, system of training skilled workers is a fundamentally sound one. It has worked effectively for just about as long as there have been skills to learn. But to maintain its effectiveness, the apprentice system must keep pace with the evolution of industry.

Today, the shortage of engineers is receiving tremendous amounts of publicity. But what about the shortage of metalworking craftsmen? While the function of the engineer is to put ideas on paper, it takes a skilled man to transfer those ideas from paper to tools, dies and machinery. If the supply of diemakers and other skilled workers gets much lower, we will run into a situation that could have serious national consequences.

Industry, therefore, must reconcile itself to one of two courses—either it must be prepared to continue with an inadequate number of skilled craftsmen, or it must find means of training more.

In today's tool and die shops, fewer than 42% of the men have had formal apprentice training. Those who lack such training have "picked up" or "stolen" ther trade, having been hired as less-than-skilled craftsmen. A plant manager often finds it necessary to hire a man who can only partly qualify for a skilled job—a practice that began just before World War I. Partially trained, these men seldom develop the skill necessary to qualify them as top-grade craftsmen.

Needed: Revamped Training Methods

That means industry must take a close look at present apprentice training practices, at its requirements for trained men, at the shops and schools where such training is given, and last but not least, at the men available for training.

Today's applicant for apprentice training is on the average 24 years old, not 16 years old as in pre-World War I days. He has a high school education. He didn't start his training earlier because he went into the Armed Services right after high school.

He is a man, and he must be treated as such—not as a 16-year old boy, and he needs enough income to be self-supporting. He now knows that formal training is the way to get into a higher wage bracket, but he wants to accomplish that training as quickly as possible, and he'll do extracurricular work to achieve that end. He's not apt to "fool around," as could be expected of a 16-year-old boy.

Today's apprenticeship applicant has been tested by a vocational counseling service or by a State Labor Bureau, before being passed on to a plant. Then the firm's own personnel department and its apprentice committee screen him closely. The applicant who passes all those requirements is sure to be a highly satisfactory craftsman—a man not to be compared with the young boys of days gone by, who more often than not were talked into apprenticeship by their families, or forced into it by circumstances.

Thus we have a man, not a boy, to deal with, and salary becomes a thing of prime importance. While today's old timers look back on their $6-a-week apprenticeships nostalgically, these are different times.

Today's 24-year-old beginning apprentice is often a man with a wife and family to support. And while he is willing to make a sacrifice now to arrive at a higher place on the economic scale later, in the interim he must live. Many have G I assistance, which helps, but usually they can't get by on low wages for four years. This, according to the U S Department of Labor, is the primary reason why men leave before completing their apprenticeship.

Strong Incentive to Finish

By enabling the apprentice to reach the Class "C" journeyman wage level in something like two years, rather than the usual four years, the Greist 4000-Hour Plan offers a young man strong incentive to finish out his apprenticeship. Too, because he has been trained to meet the needs of a particular plant, he is less likely to go elsewhere after completing his apprenticeship.

The average shop is unable to give complete training in all phases of tool and die making. The trade has changed a lot in the last 50 years. We have now become a nation of specialists.

For example, a large plant doing sheet metal and stamping work may use 50 diemakers, but may not have a total of 1000 hours work in fixture building in the course of a year. Other shops employ a large number of jig and fixture makers who may never be called upon to build a compound die.

Many shops make no new dies, jigs, or fixtures, but they retain a large number of skilled mechanics for maintenance and repair. Some specialty shops make nothing but die casting molds, some make only machinery, some make special milling cutters, others screw machine form tools.

Every industry has its own entirely different pattern of requirements, yet each needs skilled craftsmen. None has the equipment or the variety of work to give a diemaker apprentice the complete all-around training he needs to become a fully qualified tool and die maker. However, they do have the facilities to train men for their own type of work.

It stands to reason, too, that a qualified and trained, first-class tool and die maker from any of the specialty shops (tool and die job shops, press metal manufacturing, machine tool plants, plastic mold builders, cutter and cutting tool plants, aircraft body plants, aircraft engine plants, etc) could not go into another type of specialty shop and become a top man, without undergoing extra training.

Industry could not in the past, and certainly cannot under present conditions train an apprentice to the point where he can be classified as a top or fully trained man upon graduation.

In the tool and die industry, for the last 40 years all classification of skilled workmen has been based upon age, experience and knowledge of the trade. As men became more experienced and trained in the work, they were advanced to the top grade. In the tool and die industry such skill comes only from experience.

That's why today's apprentice policies are out-

A constant close check on progress makes for a successssful apprentice . . .

LEFT: Greist apprentice committeeman William Healy casts a critical eye on a threading operation performed by apprentice John Henry. RIGHT: Greist's apprentice committee later reviews John Henry's job performance. From left: Albert Olsen, William Healy, John Henry, Robert Burgess, George Pratt

moded, and badly in need of certain changes to fit them into modern industrial economy.

In line with this thinking Greist Mfg Co, working with Thomas Yoczik, Chief of the Connecticut Apprentice Training Division of the Labor Department, and with the Connecticut State Apprentice Council, has revised its apprentice program:

The term "tool and diemaker apprentice" has been changed to "diemaker apprentice," because it conforms to actual training at Greist.

A complete restudy has been made of the hours allotted to each machine. This has then been scaled down to the time necessary to train an apprentice in this specialized field. Careful study indicated that the old 8000-hour program was not warranted. Ample basic training for a man with no previous experience, it was found, can be given in 4000 hours. A graduate of a modern state trade school can qualify in as little as 2000 hours.

Selection of men for training is most important. Applicants must have basic mechanical ability and should show possibilities for advancement.

Connecticut's State Labor Bureau does an excellent job in screening such applicants.

Greist's new program is geared to its own needs...

The present 600-hour related training program, set up for 8000 hours' apprentice training by Connecticut's Bureau of Apprentices, is considered necessary to the 4000-hour course, too. Graduates of modern trade schools, because they have had such training, are exempt from further related studies but are encouraged to continue such studies on their own.

Trainees may qualify for a Greist Apprentice Certificate after completing 4000 hours of diemaker training upon:

- Satisfactory completion of related training work at the Eli Whitney Trade School.
- Satisfactory completion of a written test or examination relating to the work. This is given by Greist's Apprentice Committee.
- Satisfactory evidence of ability to complete a given job, based upon the training given. The committee's analysis of the quality of this work shall be considered the best evidence of the apprentice's qualification to assume a journeyman's status.

If the apprentice does not pass these tests to the satisfaction of the committee, he is required to take further training, and is re-examined after each succeeding 1000 hours. His wages during this period will remain at the same rate as during the 3500-4000 hour training period.

Upon the issuance of a Greist apprentice certificate, the apprentice is promoted to Class C journeyman, and paid the current wage of this classification. His future "progress-and-employee" rating will be determined and classified by the Apprentice Committee until he is eligible for, or receives, his State Certificate.

The tools and tool box issued to the apprentice at the beginning of his training will not become his personal property until he has been granted the State Apprentice Certificate.

A report is made to management on each apprentice who has received his certificate. This report includes the Committee's opinion of the apprentice, and recommendations or suggestions for his future development.

After the apprentice has completed his 4000-hour training, he is employed on diemaking and die repair until he is eligible for the State Certificate (2300 additional hours).

Facilities at Greist are such that it can offer only diemaker training. A member of the committee checks an apprentice's training hours against a master record each week, and the apprentices are also checked out by the Apprentice Committee, by means of a written examination after each 1000 hours of training.

(*Continued on next page*)

Greist's 4000-hour diemaker training schedule...

WANT COMPLETE DETAILS ON THE 4000-HR PLAN?

A copy of Greist Mfg Co's "Diemaker Apprenticeship Standards," (8 pages, mimeographed) will be sent free to any American Machinist subscriber upon request to Reader Service Department, American Machinist, 330 West 42nd St, New York 36, N Y.

Preliminary

Tool crib-care and knowledge of tools, supplies, cut off stock-die steels. 80 hours maximum.
Assignment to power press department, press set up, knowledge of presses, safety devices, part ejection. 80 hours maximum.
Assignment to machine department. Production milling set up. Production fixtures. 80 hours maximum.
Assignment to automatic screw department. Cam lay out, speeds and feeds. Set up. Knowledge of screw machines. 80 hours maximum.
Operation of tool room machinery. Safety and theory. Various set ups.
Miscellaneous theory and safety measures.
Total hours: 400

Drill Press

Drill grinding for various materials.
Care and knowledge of drill press tools.
Drilling allowances for reaming sizes.
Countersinking, spot facing, counterboring, burring.
Clamping work to table, parallel work.
Layout and drilling to prick punch for accuracy.
Drilling straight accurate holes, checking table for accuracy with spindle.
Feeds and speeds, materials, drill sizes.
Drilling hardened steel with carboloy drills and black drills. Speeds and feeds.
Safety measures—proper ways of holding work.
Miscellaneous lapping, polishing, fitting.
Suggested time: 200 hours

Milling

Setting up work by various methods.
Cutters and their uses.
Slotting and cutoff.
Speeds and feeds.
Gang milling, spacing.
Miscellaneous index work, helical milling.
Safety and operation.
Boring bar work.
Climb milling.
Carboloy slab milling.
Fly cutting, form cutting.
Suggested time: 250 hours

Lathe

Turning rough and finish.
Grinding tool cutters and boring bits.
Threading internal and external.
Speeds and feeds.
Grinding, internal cylindrical.
Boring for sizes. Reaming.
Turning small punches.
Use of micrometer stops.
Steady rest support. Strapping on centers.
Face plate. Strapping.
Drilling reaming—speeds and feeds.
Chucking—4 jaws, 3 jaw.
Ballbearing center work.
Miscellaneous—lapping, fitting.
Suggested time: 325 hours

Shaper

Plain shaping—various materials.
Finishing cuts—grinding cutters.
Dovetails—shapes.
Angular table work.
Miscellaneous—safety.
Suggested time: 50 hours

Jig Borer

Hole locations—drilling—reaming.
Hole locations—drilling—boring.
Jig grinding.
Checking work for accuracy—gages and measuring blocks.
Miscellaneous—Indexing.
Suggested time: 175 hours
TOTAL MACHINE TRAINING HOURS: 1000

Grinding

Plain grindings.
Selection of wheels for various materials, finishes.
Progressive die sharpening.
Form grinding.
Gage grinding.
Grinding for squareness—angles.
Sine plate work.
Index work.
Cylindrical work (grinding).
Taper grinding, internal and external.
Shoulder grinding.
Miscellaneous—safety theory.
Total hours: 400

Tool Making and Repair

Construction of drill jigs and fixtures.
Close tolerance fits.
Rebuilding and repairing special fixtures, gages.
Filing, scraping, lapping, fitting.
Miscellaneous—indexing, timing, assembly.
Total hours: 200

Diemaking and Repair

Constructing a new blanking die.
Altering and repairing progressive dies. Difficult punches and sections.
General die repair for production requirements.
Making die try outs. Working with a try out man.
Working with a lead man. Detecting faulty operation or defective material.
Miscellaneous safety—general theory, practice.
Altering and repairing difficult nesting and close tolerance fits.
Total hours: 1400—preliminary training.
Total hours: 2300—for State Certificate.

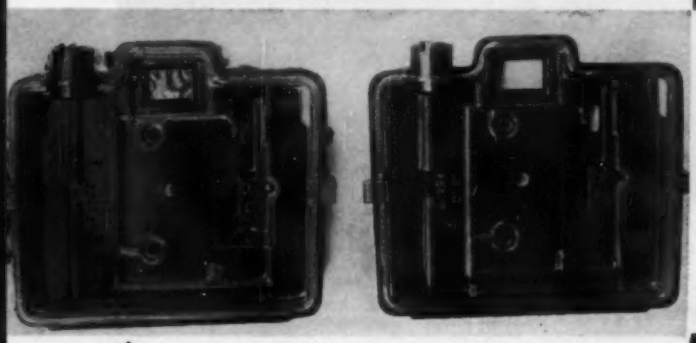
Trade School

Blue print reading—theory.
Trigonometry, plane geometery, satisfactory completion of state requirements.
Total hours: 600.

Mechanized finishing for plastic parts

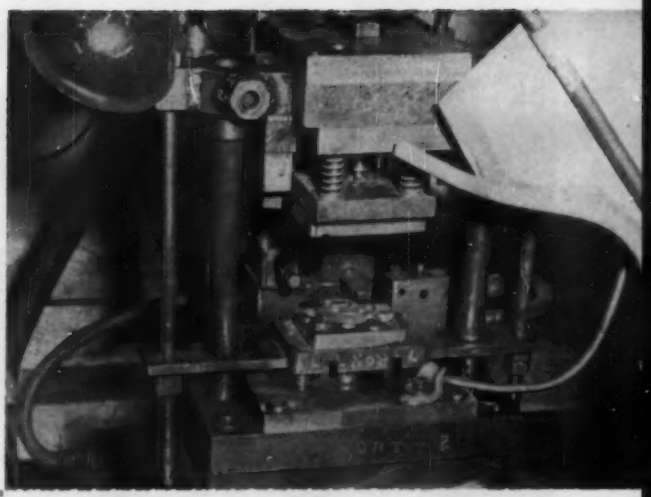
High-volume plastics molding requires high-volume finishing and deburring. Here are a few of the techniques employed by Auburn Plastics, Inc, on a large order for camera cases

PAT LOMBARDO, plant supt, AUBURN PLASTICS, INC, AUBURN, NY



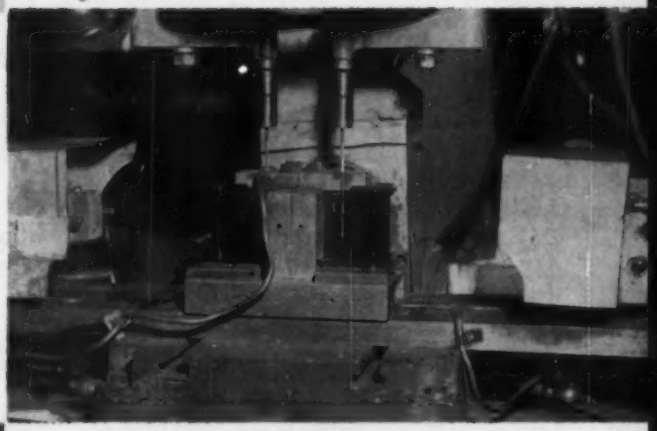
Camera case before and after . . .
broach deburring. The front viewer window and a dozen other holes are cleaned out simultaneously at an average rate of 1350 pcs per hr

Conveyor fixture opens automatically . . .
to receive camera body for sandblasting to remove high-gloss finish from interior walls. Belt is moving from right to left. As the masking-holding fixture approaches operator, spring lid is raised so that part can be inserted, after which lid snaps down over part. A similar arrangement at other end of conveyor provides automatic ejection

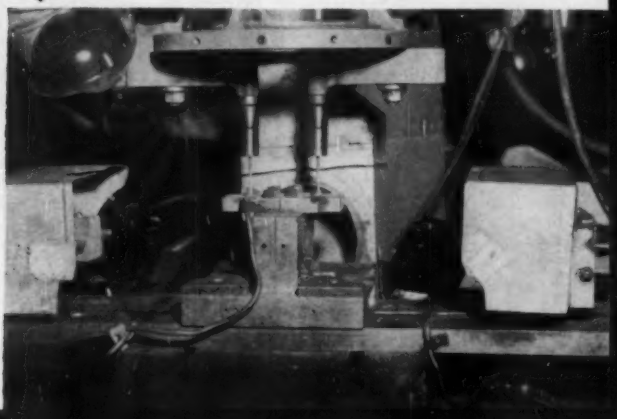


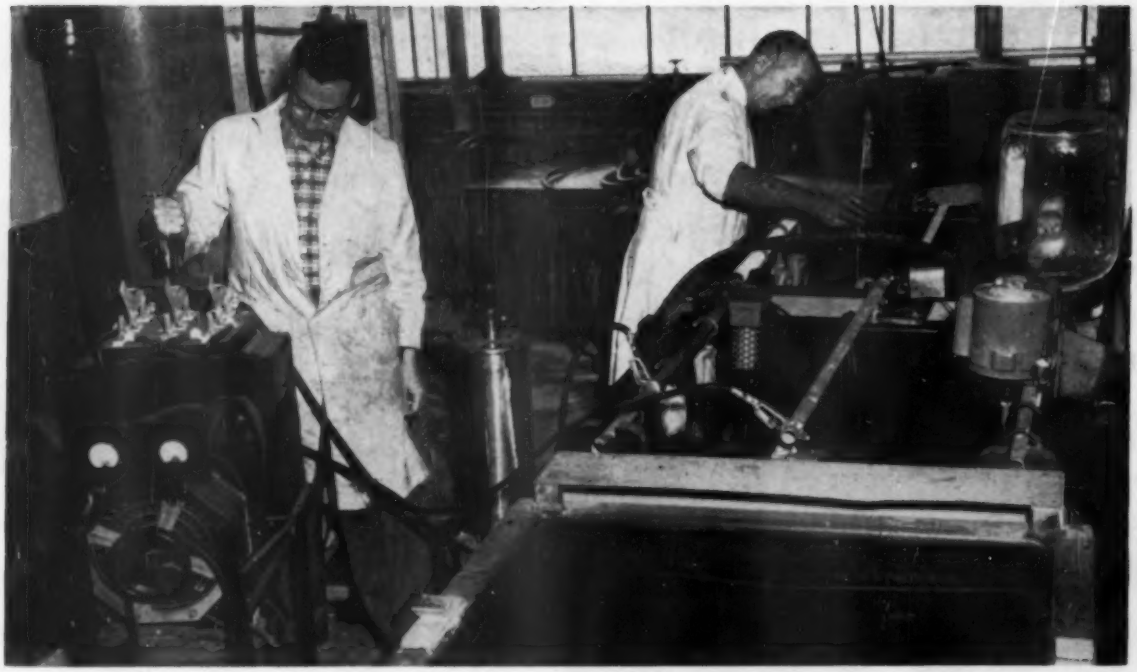
Special machine deburrs camera cases . . .
with broaching action. Machine is built on an arbor press frame and is equipped with pneumatic cylinder. Automatic safety shield swings in front of die when release is tripped

Spring-clip holes are drilled . . .
in twin operation. Handling two camera cases at a time, the operator locates them on the fixture and then activates the machine by two switches connected in series



Parts are automatically ejected . . .
into chute by compressed air. (Hoods on either side are part of dust collection system.)





Fatigue problems are licked in plating aircraft parts with a nickel sulfamate bath. Plated coatings containing tensile stress usually cause premature fatigue from stress cracking, so this techinque considerably improves the quality of nickel-plated parts

Life of aircraft parts is increased...

Expensive components are salvaged...

and quality is improved with...

A nickel sulfamate bath is used extensively in nickel-plating operations at Ryan Aeronautical Co's Engineering Laboratories for smooth, ductile deposits combined with hardness and high tensile strength. Here's a description of this new plating technique

One of the major problems in aircraft nickel plating is high internal stress in deposits from all-chloride and high-chloride Watts baths. Excessive stresses can cause peeling, cracking, crazing, warping, blistering, distorting, shrinking, and even complete destruction and failure of plated metals, either as structural units or as protective coatings.

Not only may these coatings fail within themselves, but they may also induce premature fatigue failure of the underlying base metal.

Nickel deposits from nickel-sulfamate electrolyte, however, have fine grain structure, resulting in deposits that are smooth and ductile, with a slight sheen in appearance. The color is whiter than chloride deposits, indicating a higher purity of nickel without chlorine inclusion. Tensile strength ranges from 60,000 psi to 130,000 psi, depending upon the conditions under which the bath is operated. Ductility ranges from 30% elongation in 2 in. to a low of 6% elongation at a hardness of 550 Vhn. Hardness can be controlled from 200 Vhn to 550 Vhn by varying the operating conditions.

When depositing nickel under compressive stress, the nickel-sulfamate bath exhibits exceptional leveling power. Brush surface-analyzer measurements have indicated a reduction in surface roughness from 120 to 7 mu in. rms for a plate 0.0005 in. thick.

Fatigue failures originate at the surface, so weakness of a surface condition can reduce metal life under fatigue conditions. Stressed plates can cause as much as 46% reduction in the fatigue strength of underlying steel. Nickel deposited compressively by the nickel-sulfamate bath causes no strength reduction and, in some cases, improves fatigue strength.

Sulfamic acid used in the bath is a white, crystalline, inorganic solid. It is non-hygroscopic and non-volatile. In addition, it may be safely and conveniently handled and stored—a matter of great interest to safety engineers. In strength it is similar to sulfuric acid, as is its chemical nature. The

Increased life of metal is gained by plating jet-engine bearing housing with nickel-sulfamate baths. By using a metal "buildup" obtained with this technique, valuable but out-of-tolerance parts made of Inconel-X and other alloys are salvaged for such aircraft components as afterburners and ramjet and rocket engines

Embrittlement failure in aircraft parts plated by conventional methods is illustrated by these examples. Internal stresses in such nickel deposits have been recorded as high as 60,000 psi

"Stress – Free" plating

EDWARD CALDERON,

process engineer

RYAN AERONAUTICAL CO

SAN DIEGO

difference is in the substitution of an NH_2 group for one OH group.

The metal salts of sulfamic acid are extremely soluble, and in many instances are the most soluble metal salts known to science. Sulfamic acid is monobasic and will react with metals, oxides, or carbonates to yield the corresponding metal sulfamate by replacing one hydrogen atom associated with the hydroxyl group.

BATH COMPOSITION

A convenient method of preparing nickel sulfamate can be obtained by reacting a solution of sulfamic acid with nickel carbonate. The nickel sulfamate bath presently in use at Ryan is controlled to this composition:

Nickel sulfamate	60 oz/gal
Nickel metal equivalent	12.2 oz./gal
Boric acid	4 oz/gal
Anti-pit agent (wetting agent	0.05 oz/gal
pH of bath	3.0 – 4.5
Temperature	100 – 140 F
Density	29 – 31° (Baumé)
Agitation	cathode bar movement, solution circulation, or both
Anode efficiency	100%
Cathode efficiency	98 – 100%

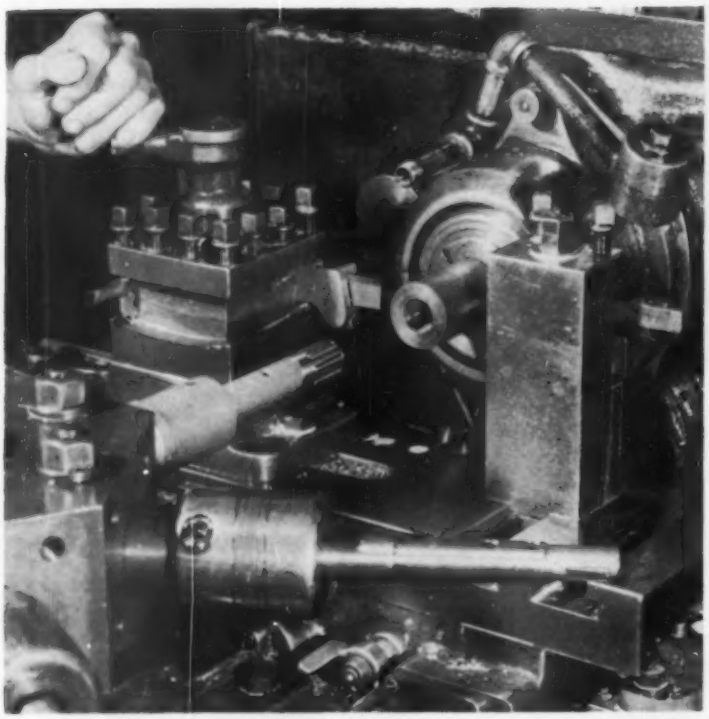
It is important to accurately measure and precisely control the pH of the bath. As the pH increases, the compressive stress in the deposit and hardness increase, as does the throwing power. Sulfamic acid is used to lower the pH, while nickel carbonate raises the pH. In addition, the bath temperature must be held to close limits in order to consistently obtain the desired properties. The hardness of the deposit decreases with increase in temperature within the temperature limits of the bath.

By means of precise physical, chemical, and electrochemical controls of the processing, the properties and characteristics obtained are:

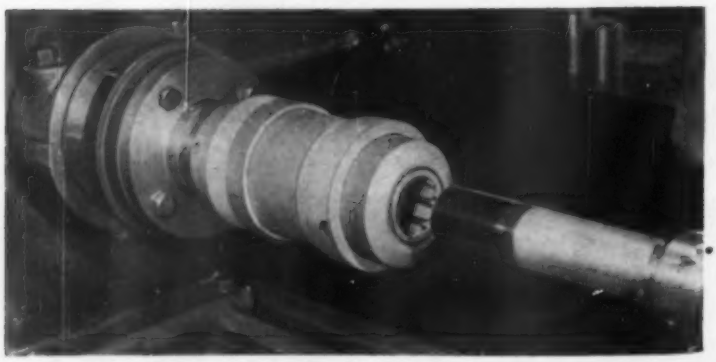
1. Stress-free deposits
2. Nickel deposits of high chemical purity
3. Improvement in fatigue strength of underlying base metal
4. Excellent grain structure and ductility
5. High-level action for easy buffing
6. High tensile strength
7. Excellent corrosion resistance
8. Hard deposits with good ductility
9. Heavier, harder, more ductile deposits without buildup of trees and nodules
10. Ductile deposits with controllable compressive and tensile strength

MULTI-ROLLER BURNISHING:

Short cut to a fine finish



Multi-roll tool burnishes bore . . .
immediately after drilling and boring and without removing workpiece from machine. Floating holder supports burnishing tool for perfect alignment. Clean cutting oil is flooded over tool to flush and clean burnishing rolls throughout the operation



Headstock drives external burnishing tool . . .
but positions can be reversed if more convenient, or the work can be done on other machines such as drill presses or screw machines. Long shafts can be burnished by feeding them through the tool and into hollow lathe spindle if necessary

Under proper conditions, multi-roller burnishing can achieve 4 mu-in. finishes quickly and inexpensively. Here are the factors to consider and what you can expect of the process

M J DELANY, JR, president
MADISON-FAESSLER TOOL CO,
MOBERLY, MO

Burnishing with multi-roller tools is being employed to an increasing extent in metalworking plants, because it is often faster and less expensive than other surface-finishing methods. It improves the finish of either internal or external cylindrical parts, and at the same time increases their surface hardness. In addition, no special equipment is needed; the operation frequently can be performed on the same machine on which the part is turned, drilled, or bored.

On most steels the process can develop, in one pass of the tool under normal production conditions, surface finishes of 4 to 5 mu-in. or better. Even in porous metals like some types of cast iron, finishes of 10 to 16 mu-in. are easily obtained. "Spongy" metals like bearing bronzes and cast aluminum alloys generally can be finished to 4 to 8 mu-in. And, during the process, the surface of the metal is cold worked, compacting the grain structure and increasing surface hardness.

Final hardness imparted to the worked surface with multi-roll burnishing tools depends upon the amount of metal displaced, as well as upon the work-hardening characteristics of the metal itself. In a typical application where a 1.000-in.-dia bore in annealed SAE 4140 steel was enlarged by 0.0015 in., surface hardness of the bore was

increased by 10 points on the Rockwell "C" scale.

Power requirements for burnishing with multi-roll tools are very low, because only minimum values for external thrust and torque are developed. A 2-hp machine, for example, is generally adequate for internal cylindrical tools as large as 5-in. dia. Parts with bores as large as 2 in. can easily be held by hand against the torque and thrust created by the tool. Work-holding problems are therefore considerably simplified when designing fixtures and machine setups to be employed in surface finishing with this type of tool.

DEVELOPMENT OF THE TOOL

Multi-roll burnishing tools bear little resemblance to the burnishing rolls which have been used for many years in railroad backshops and other metalworking plants for roller-burnishing journal surfaces on axles and other shafts. Instead, their development is based on experience with roller-head tube expanders originated some 75 years ago to set tube ends in boiler and condenser endplates; and they were finally evolved from the Faessler-Maupin roller-burnishing heads developed in 1927 for applying bushings and bearing brasses in railroad shops.

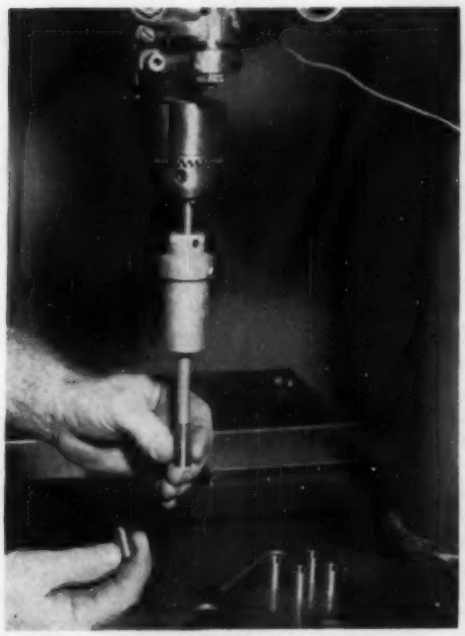
Faessler - Maupin multi - roll heads were used during World War II for mirror-finishing the bores of mortar tubes (*AM*—Apr 16 '41, p345) and other ordnance parts.

DESCRIPTION

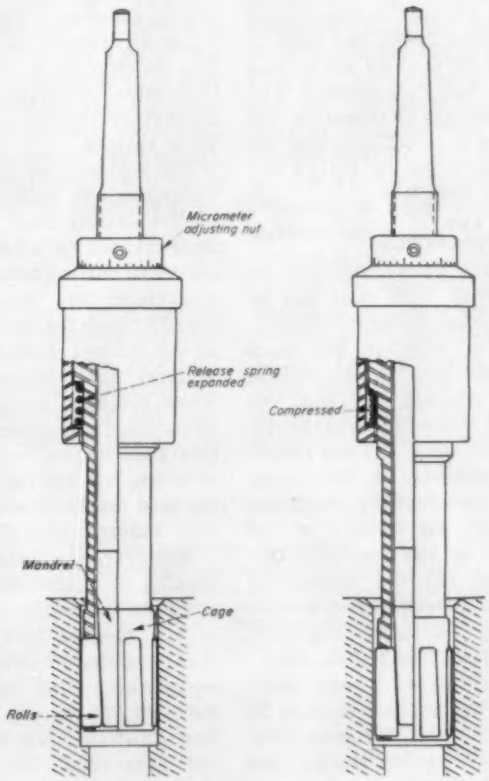
Multi-roll burnishing tools for finishing internal or external cylindrical surfaces are best compared with tapered-roller anti-friction bearings, one race of which (the workpiece) is left in the soft state. The tool consists of a number of hardened, tapered rolls spaced evenly by a retaining cage around the surface of a hardened steel mandrel which is tapered inversely to the rolls. This combination of tapered rolls and tapered mandrel makes it possible to adjust the size (diameter) of the tool by turning a simple micrometer adjusting nut and locking it in position.

The tools are self-feeding, because the rolls are lightly skewed (set at a slight helix angle to the axis of the mandrel). Thus, they will draw themselves into or onto the workpiece independently of machine feed or any external power.

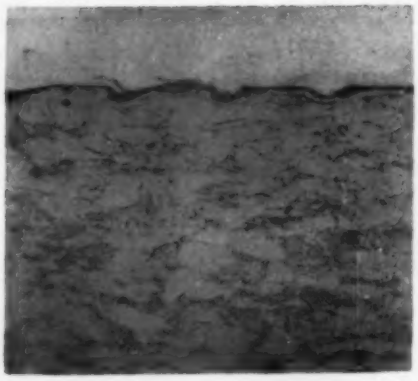
Automatic release of the rolls when the operation is complete is another feature. If the tool is restrained in any way from feeding forward at its own natural rate, the rolls will feed forward independently of the tool and move off the tapered end of the mandrel. The tool then collapses and releases the rolling pressure. In most setups the restraint is provided at the proper point by either a stop on the machine or a stop collar on the tool.



Tool develops very little torque . . .
because the burnishing is done by rollers. Micrometer ring at top of tool provides adjustment to suit diameter of workpiece



Rolling pressure is released automatically . . .
In normal position (left), tapered rolls are expanded against workpiece by mandrel. When forward motion of tool is stopped (right), the self-feeding rolls continue to advance down taper of mandrel, collapsing the tool and compressing the release spring. When tool is withdrawn, spring returns rolls to size established by adjusting nut



Roller-burnishing flattens peaks . . .

and fills valleys as shown in 100x photomicrograph of section across finished surface. In this example, the rolls displaced surface of annealed SAE 1020 steel less than 0.003 in., changed grain structure to a depth of 0.005 to 0.007 in., and developed a 3 mu-in. finish

The same result is accomplished when the rolls emerge from the workpiece bore approximately two-thirds of their length.

Feed rate depends upon the design of the tool and, to a slight degree, upon the amount of metal displacement required. The tool should be allowed to feed at its natural rate without being forced or retarded. On machines equipped with automatic feeds, the rate of feed should be slightly more than the natural feed rate so there will be no possibility of retarding the tool, causing it to collapse and release rolling pressure before the operation is complete.

OPERATION AND SURFACE PREPARATION

Almost any metal that can be machined with HSS tools can be roller-burnished without difficulty, regardless of whether the piece has previouly been turned, drilled, broached, reamed, ground, or honed. The degree of finish developed depends upon (1) the physical characteristics of the metal being worked—ductility, hardness, porosity—(2) the quality of the surface left by the preceding operation, and (3) the amount of stock left to be compacted and/or displaced by the burnishing rolls.

Generally, for best results, workpieces to be finished by this process should not be harder than 25 to 40 Rc. However, for some metals that work-harden rapidly, the initial hardness must be appreciably lower to insure economic tool life.

The important consideration when preparing for roller-burnishing is to create a surface that will cold work readily. Examination of photomicrographs shows that the metal is displaced principally in a direction perpendicular to the axis of the rolls, not axially along the surface as is the case when button-type burnishing bars or burnishing balls are pushed through a hole.

If the surface is too smooth, more rolling pressure is required to develop an acceptable finish, as it will be necessary to expand the body metal of the part and to move some of the metal axially along the work surface.

The best surface for roller-burnishing is one with a pronounced peak-to-valley feed pattern such as is created by a tool with a single-point cutting action. With such a surface, the burnishing rolls readily cause the peaks to flow into the valleys, creating a smooth, uniform final surface. Therefore, when grinding boring tools, it is advisable to develop rake and clearance angles that will tend to increase, not reduce, the depth of the feed marks. Generally, a small nose radius is also desirable.

However, the initial micro-inch reading of a surface is not necessarily an indication of final results to be expected from the process. It is possible, for example, to roller-burnish steel surfaces that measure 250 mu-in. initially to a final finish of 5 mu-in. or better in one pass. And 125 mu-in. steel surfaces are being roller-burnished in production to finishes of 1 to 5 mu-in. without difficulty.

Reamers and gun drills have been ground successfully to the desired boring pattern, but these tools must be sharpened and used with care, as roller-burnishing tools will not clean up gouges or tears.

WALL THICKNESS

It is necessary, when machining a surface prior to roller-burnishing, to allow for the enlargement of bores, or reduction of external diameters, resulting from metal displacement during burnishing. The amount of stock which must be left varies with job conditions, physical characteristics of the material, wall thickness of the part, nature of the machined surface, and quality of surface finish desired.

The accompanying table on this page shows typical stock allowances for burnishing with multi-roll tools. However, because of the number of variables involved, these should be considered estimating yardsticks only—the starting point for experiment with an actual workpiece.

Because considerable compressive force must be exerted by the rolls to cold work the metal and develop the desired finish, walls must be thick enough to resist deformation. If the walls are too thin, they will expand away from the rolls, and the rolls will not be able to exert enough pressure to achieve the desired finish.

If, in addition to being thin, the wall has variations in its thickness, further difficulties can be expected. On an ID for example, at points where the wall is thickest, the resistance to rolling will be greatest, and the final diameter will be smaller than at points where the wall is thinner.

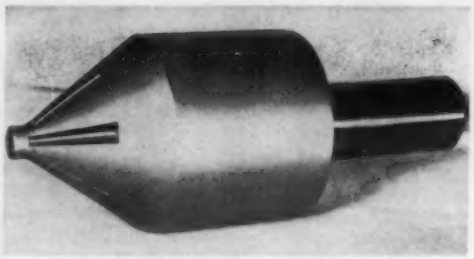
TYPICAL STOCK ALLOWANCES FOR BURNISHING WITH MULTI-ROLL TOOLS

Workpiece Diameter (ID or OD)—Inches	Stock Allowance (On Dia)—Inches
0.218 to 0.500	0.00075
0.531 to 0.968	0.001
1.000 to 1.750	0.0015
1.781 to 2.500	0.002
2.531 and Larger	0.003 to 0.006

Note: These values are approximate and are intended only as "yardsticks" for estimating the required stock allowance. Exact allowance for a given job can be determined best by experimenting with an actual part

However, the difficulties encountered with thin-walled parts sometimes can be reduced if not eliminated by controlling pre-machining tolerances closely, minimizing the amount of stock to be compressed during burnishing, and using a fine cutting-feed pattern. Preferably, design of the part should be changed, if possible, to eliminate the thin walls.

Problems can also develop when there are intersecting holes, keyways, and grooves. Such elements tend to relieve the rolling pressure as the rolls pass over them. However, in most cases tool design and operating procedures can be modified to reduce the effects of these interferences.



Special tool burnishes chamfers . . . and other special roller-burnishing tools have been developed for tapers, radiuses, and flat faces. However, such tools are not self-feeding; they require externally applied force

ROLLING TO SIZE

Where consistency of surface finish is a primary consideration, the multi-roll burnishing tool is not a sizing tool. It does not remove metal, and its effectiveness in sizing is limited by the springback characteristics of the metal being worked. Also, the tools will not correct out-of-roundness or taper conditions to any great extent. Therefore, tolerances for final size and accuracy of the finished surfaces must be established in the preceding machining operation.

An exception is found in soft metals like bearing bronzes and cast aluminum alloys which have practically no springback when deformed and can be "set out" easily. Holes in such metals which vary as much as 0.001 to 0.0015 in. usually can be brought to a single, uniform size with one pass of the tool. Holes varying over a greater range can be brought into a much smaller range of variation with one pass and then sized accurately with subsequent passes.

Multi-roll burnishing tools can be employed, to a limited extent, for sizing holes in other metals when dimensional accuracy is more critical than consistency of surface finish. Under such circumstances, the tool can often be set to size parts that are out of tolerance without changing the size of the parts already within the tolerance range. However, because the compressive pressures will vary considerably when rolling parts of different diameters, there will be a variation in the surface finish from part to part.

APPLICATIONS

These tools have been particularly useful in finishing surfaces that will be in contact with soft packings or O-rings. In addition, as the process flattens out tool marks and compacts and hardens the burnished surfaces, parts can be assembled more accurately by press fitting, because there will be no interference from tool marks. Similarly, the clearance between assembled parts can be maintained for a longer service life, and failure from stress concentration is also reduced.

For some applications, such as the production of hydraulic cylinders for tractors and other farm machinery, the process finishes the bores of seamless steel tubing without prior machining. However, such tubing must be of "select finish" or "pump cylinder finish" quality, because the multi-roll burnishing tools will not completely remove deep mandrel marks, scratches, or other surface imperfections commonly found in commercial grades of seamless tubing.

Other multi-roll burnishing tools employing similar rolls have been developed for finishing chamfers, tapers, radiuses, and flat faces. These tools, however, require externally applied force to create the necessary rolling pressure.

FEED RATES FOR INTERNAL ROLLER-BURNISHING TOOLS

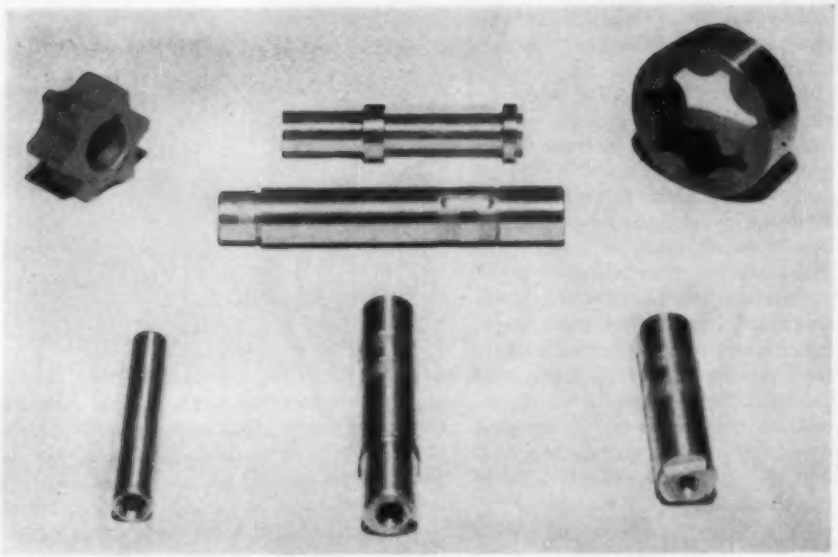
Tool Diameter (Inches)	Recommended Speed—Rpm	Typical Feed Rates (In. per Rev)	(In. per Min)
0.250	700	0.005	3.5
0.500	500	0.011	5.5
1.000	500	0.015	7.5
1.500	400	0.028	11.2
2.000	325	0.036	11.7
3.000	200	0.060	12.0
5.000	100	0.130	13.0

Note: External tools feed approximately twice as fast as the internal tools above. A multi-roll cylindrical burnishing tool should be allowed to feed at its own natural rate, neither being forced nor retarded. Either the work or the tool can be rotated. Tool must be aligned perfectly with the work, so a floating holder is recommended

MINIMUM APPROACH TO BOTTOM IN BLIND-END OR SHOULDERED BORES

Tool Diameters (Inches)	Minimum Approach to Bottom (Includes Clearance for Release)	Clearance for Release (Inches)
0.218 to 0.484	3/32	1/32
0.500 to 0.968	1/8	3/64
1.000 to 1.750	3/16	1/16
1.781 to 2.500	3/16	1/16
2.531 to 3.375	1/4	1/8
3.406 to 8.000	17/64	9/64

Note: These figures allow clearance for the front web of the roll cage, and for the radius and relief on the ends of the burnishing rolls on standard tools. If a closer approach to the bottom or shoulder of a bore is necessary, a "bottoming" type of tool sometimes can be developed to finish the bore down to the radius at the bottom



Castings and low-carbon-steel parts for Eaton's hydraulic steering units must all be processed through the same heat-treating furnaces and quench tanks. Top row—inner rotor, relief valve and shaft, outer rotor; bottom row—various shafts

Quenching oil does make

Refinements in heat-treating come from close attention to cost reductions from every angle. Here is a case example that demonstrates how you should relate the properties of a quenching oil to the operations in use and the kinds of work being processed

CHRIS HENDRA,
chief metallurgist,
Pump Div, EATON MFG CO,
MARSHALL, MICHIGAN

About a year ago we were faced with a serious production problem —how to heat-treat low-carbon steel parts and grey-iron castings for our hydraulic steering units and reduce warpage, distortion, and shrinkage to ±0.0005 in. without sacrificing the required Rockwell hardness. The cost of rejects and salvage operations under conditions existing at that time, had they been allowed to continue, could conceivably have run as high as $30-50,000 annually.

The culprit proved to be the heavy quench oil in our batch-type furnaces, that made it almost impossible to stem excessive distortion. Also, we found that after a short time a sludge formed because the oil had insufficient resistance to oxidation. This "gunk" cut the service life of the oil in half, increased replacement costs.

VISCOSITY INDEX WRONG

Because we produce over 1,000,000 automotive and truck steering pumps yearly, we had to find a way to reduce rejects of inner and outer rotors, relief valves, and shafts. Actually, the oil's viscosity index was too high for the work going through. The heavier oil had been installed only because of its high viscosity, but this characteristic prevented the full use of the quench bath temperature variable. The oil was heavy on the low end and dropped rapidly.

REQUIREMENTS FOR OIL

What we needed was a high-speed oil with low viscosity at high temperature that would be equally suitable for both carbon-nitriding of the low-carbon steels and simple hardening of the grey-iron pump housings. Ideally, such an oil should quench satisfactorily a wide range of workpieces and assure improved hardness on a given piece at set conditions. After tests, Voluta Oil 972, made by the Shell Oil Company, was found to have the following characteristics:

1. Longer oil life. This oil has been in used for over a year now, and just enough is added (about 10 gal weekly) to make up.

2. Work that has been heat-treated is clean, bright, and scale-free, simplifying final grinding to dimension. Because of the oil's lower viscosity index, there is less carry-off.

3. The oil can be used at a wider range of quench temperatures (150 to 400 F). At 250 F, Voluta quenches faster for greater depth

Parts are heat-treated and quenched in a two zone Ipsen hardening furnace. Quenched work is in protective atmosphere until withdrawn from furnace. Quench oil temperature is closely controlled

a difference

and uniformity of hardness; at 375 F there is better distortion control.

4. Rejects from distortion, warpage, and shrinkage eliminated.

5. No sludging takes place.

The oil functions in an Ipsen furnace, which is a two-zoned heating operation with controlled atmosphere in both the heat and quench chambers. While the furnace will handle case hardening, carburizing, and carbon-nitriding, we prefer the latter because it is easier to obtain the end result. Parts up to 600 lb per load are placed in 22 × 32 in. wire baskets which are stacked near the furnace. When a batch of parts has been brought to heat (usually between 1500 and 1600 F for most of our parts), the basket is moved automatically into the sealed zone for oil quenching, while the operator pushes a new load of parts into the first zone. A screen is used to space the work, which remains stationary while the quenched oil is circulated around it. The quenching cycle of batch lots does away with manual handling and permits holding of uniform conditions.

Direct loading into the heating zone eliminates the possibility of furnace-atmosphere problems that might cause oxidation of heated parts about to be quenched. In this type of batch operation, a sealed, controlled atmosphere throughout the entire cycle is important to satisfactory heat-treating. Present plant expansion plans include the installation of newer types of radiant-tube furnaces.

The simple hardening of the grey-iron pump housings with Voluta Oil 23 is a comparatively new process for us. The castings weigh 6 lb and are 6 in. in diameter. Formerly, it was impossible to meet hardness specifications, the castings being so soft that they had to be sent back to the foundry. Now, they are held for ½ hr at heat and then quenched for 10 to 15 min for maximum hardness that is consistent. The castings are then tempered.

SHALLOW CASES

In the main, most of the pump parts are hardened with 0.025 to 0.040-in. case with an over-all minimum rating of R_c 58. Some parts require a shallow case (0.010 in. maximum) with a reading of 88 on the 15N scale. On 8620 steel, a R_c 58 minimum is specified on the outer surface and R_c 30-40 at the core. Relief valves (1113 steel) are held for 2 hr at heat and quenched for 10 to 15 min. for a 0.020-in. case. Parts that need a 0.040-in. case are held for about 5 hr at heat before quenching.

Shafts made of SAE-1117 steel are carbonitrided 3 hr at 1580 F and oil quenched. The quench time is 2 min at high-speed flow and 8 min at a low-speed oil flow. The atmosphere is maintained with a dew point of 25-30 with 300 CFH carrier gas and 20 CFH natural gas along with 10 CFH of ammonia.

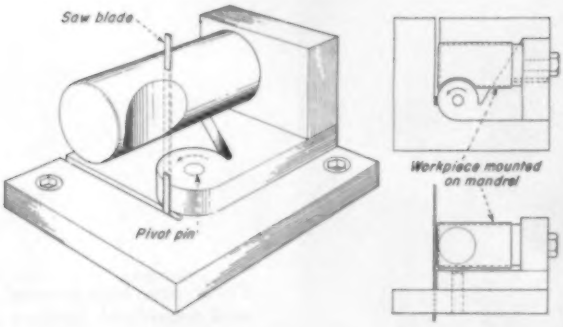
CAST IRON HEAT-TREATMENT

The permanent-mold, cast-iron outer rotors are heated to 1600 F, held for ½ hr, then quenched in oil for 1½ min with a high-speed oil flow and 8½ min with a low-speed oil flow. The atmosphere is maintained with carrier gas along with a dew point of 40-50.

Large castings that are not to specifications from the foundry are heated to 1600 F for ½ hr, quenched in oil at 250 F with 5 min at high-speed oil flow and 10 min at low-speed oil flow. Castings are drawn to 187-228 Brinell hardness.

After quenching, the parts are degreased in trichlorethylene before they are moved to the tempering furnace. Periodic tests for depth of case are made. Samples are ground in successive layers and readings are made for hardness at each level and also for core hardness.

Practical Ideas



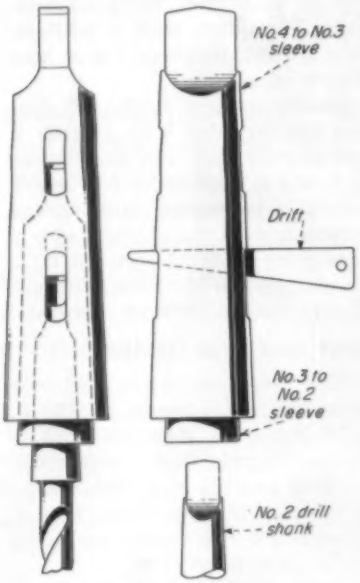
Fixture Solves Punch Problem

During the process of manufacturing components for gas burners we ran into an obstacle. We had to open a large hole in the side of drawn steel shells. These shells later had to be welded at this aperture to a tube section, making up one of the burner parts. The size of the hole precluded any practical and economical method of cutting with dies.

The bandsaw fixture shown solved this problem quickly and effectively. A shell is mounted on the mandrel and the fixture rotated to allow the sawblade to take a spherical segment out of the shell. The radius described matches that of the mating tube. With a fairly high rate of blade travel a clean, even cut results.

The fixture is built up on its own baseplate, which can either be bolted or clamped to the saw table. The rotating portion of the fixture is a weldment of two plates resembling a modified angle plate. A mandrel is mounted on the upright, and a dowel pin is driven into the baseplate to pivot the horizontal plate in a controlled radius.

Victor H Banho, Porta Alegre, Rio Grande do Sul, Brazil



Extra Drift Slot Saves Time

In shops where taper-shank drills and reducing sleeves are used in drillpresses, much time is wasted in removing a small sleeve from a larger before the drill can be drifted from the smaller sleeve. It's impossible to reach the tang of the drill without first separating the sleeves from each other.

An extra slot cut through the larger sleeve at a point to coincide with the slot in the smaller will permit driving the drill while the sleeves are kept intact. The length of the slot is laid out and machined in such a way that it will be possible to just eject the drill, or when the drift pin is driven further the sleeves will separate.

One operation is thus eliminated, and you can accomplish the same end with less motion in less time.

Andy Vena, Philadelphia, Penna

Ink Eraser Polishes Slender Rods

A high polish can be achieved on slender metal rods without the disadvantage of cutting abrasives. This is done with a disk-type ink eraser while the rod is rotated at high speed in a drillpress or lathe.

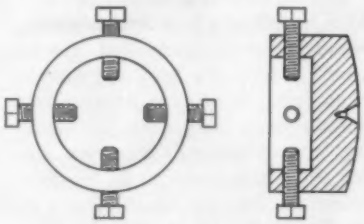
The eraser is prepared by notching the edge with a belt punch or round file. The purpose of the notch is to make it easier to traverse the eraser on the rod while it spins.

H Muller, Danboro, Penna

Adapter Provides Center

We sometimes get shafts to repair that are either bent or so badly mutilated that a section has to be cut off and a new piece welded on. Other times it may be a metallizing job on a shaft without a center. In either case, considerable time must be spent to locate a proper working center.

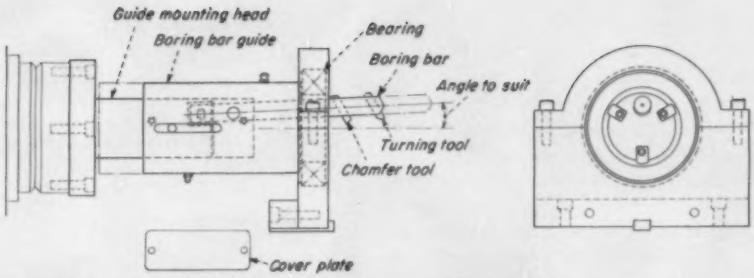
We eliminate this operation by applying a shaft-end adapter which gives us a center with a generous amount of adjustments. It may be left on the shaft during all machining operations. Should a center hole later be required in the end of the reworked shaft, a more accurate one can be produced with



this trued shaft running in a steadyrest.

An adapter is made by first selecting a grade of steel that will take heat-treating. A piece of round stock about 2½ to 3 in. diameter and about 1½ to 2 in. long will do fine. One end is then faced off and a flat bottom bore is machined. The piece is turned around and the other end is faced off or slightly rounded. A center hole is drilled as close to concentric with the opposite bore as possible. Four holes are drilled and tapped into bore, aimed at the center, to receive four capscrews. After hardening, the adapter is ready for use.

Harry Miller, Sarasota, Florida



Boring Mill Does Taper Turning

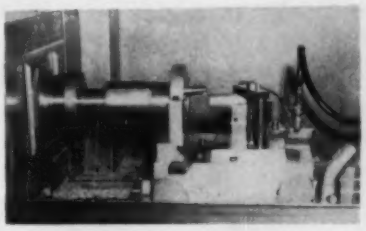
The illustrated fixture was designed and built to machine OD's on large or irregularly shaped parts not suitable for lathe operations. The part standing on the machine table in the lower right hand corner of the photo is one sample of the work produced. It is held in a simple clamping jig which centers it with the turning fixture.

The principle of this fixture is to provide a guide and feed for a boring bar working on the periphery of the work. This is done by the two main sections; the boring-bar guide, anchored and rotating in the mounting bracket, and the guide-mounting head, seated in the boring mill spindle, supplying the torque and the feed to the boring bar.

Mild machine steel or CRS is used for the guide mounting head. The boring-bar guide is made of bearing bronze. The mounting bracket can be made of either CRS or aluminum. Mounting bracket and clamping jig are both mounted on a common baseplate, which is secured to the machine table.

After the guide-mounting head has been turned to the proper diameter, length, and shank (to suit the machine spindle), the boring-bar guide is bored to receive the mounting head in a slide fit. The opposite end is then machined to take the bracket bearing and must be precisely concentric with the bore. The angular hole for the boring bar must be carefully made to give the proper angle and allow a sliding fit of the boring bar.

A pin riding in an elongated hole connects the boring bar to the



guide-mounting head. A headless screw in the mounting head has a slide fit in a slot in the side of bar guide and acts as a key between the two members. A cover plate keeps chips out of the slot.

Vernon K Moore, Muskegon, Mich

Erosive Effect of Electrolytic Action Saves Splined Bore

Recently I received a large cast heat-treated gear from a local mining company. It had previously been bored and splined to a good fit on a 6-in. shaft but had, during the heat-treatment, shrunk at one end of the bore, making it impossible to enter on the shaft.

As this gear had stalled all other operations, time, or the lack of it, played an important part. Another gear could not be secured soon enough, and standard machining methods to straighten the bore were unthinkable because of the size of the gear.

Knowing the power of electricity, I decided to try the erosive effect of electrolytic action on metal. A welding generator, an electrode, a strong salt solution ,and an old inner tube (for sealing off one end of the bore) constituted my equipment.

From the inner tube I cut a couple of 10-in. disks. They were placed on a smooth plane surface over a large steel ring which I added for a better seal. The gear was then laid on its side, arranged so the rubber sealed off the small end of the gear while it was perfectly balanced. A cathode, consisting of a 2-in.-thick disk of cast iron, was centered in the bottom of the bore. After that the bore was filled with a salt-water solution.

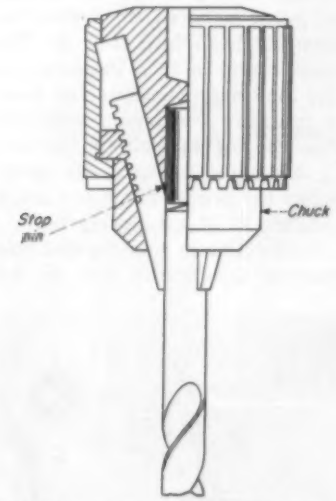
The next step was to find the proper polarities from the welding generator. This I did by connecting a small piece of thin metal to each of the welding cables. After starting the generator, both metal pieces were submerged into the salt solution. Soon one of them began showing signs of eroding. The cable connected to that piece was grounded to the gear, while the other cable was connected to the cathode inside the bore. A brass rod brazed or threaded into the cathode makes a good connector.

With the welder set on 6 volts, and enough amperes to slightly boil the water, the bore was given one hour of exposure. The welder was then shut off and the water drained. I checked the bore and found the bottom section almost perfect. Pieces of wood were added under the cathode to gradually raise it while the length of exposure time was reduced.

Care must be exercised in positioning the cathode because the erosion effect is greater where the cathode is closer to the work. My cathode was only lightly smaller than the bore but it was perfectly centered. Exact patterns are possible with a cathode made to the contours desired.

Clark Gilbert, Bridgeport, Ohio

Practical Ideas



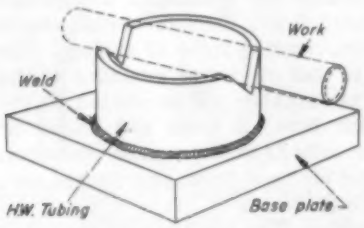
Pin Prevents Drill Slippage

Lengthen a drill bit that is a little too short for a specific drilling operation by inserting a stop pin in the chuck ahead of the bit.

Exact drilling depth can then be gaged and maintained, which is something that is difficult to do when the bit is only partly gripped without a stop pin. Partial installation of the bit results in slippage and inaccuracy of depth.

The stop pin should be small enough in diameter so it won't be gripped by the chuck jaws.

S Clark, East Bradenton, Fla



Drill Jig Made From Tubing

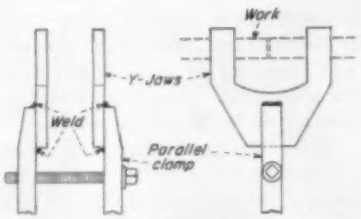
After having butchered up many standard V-blocks in the drillpress, I made the drill fixture shown in the sketch. It not only stands up longer because the drill need not touch the V-slots, but it will also save small drills at the breakthrough, as the drill point is clear of obstructions.

A short piece of heavy-wall tubing and a square piece of plate are the necessary parts. The two ends of the tubing are first faced off to make them parallel with each other and square with the axis. The resultant ring is then centered on the plate and welded to it.

The V-slot machined through the center of the tubing can be produced in either a shaper or a milling machine. The only thing to watch for is to make the V-slot parallel with the underside of the base plate, unless a special angle is demanded.

This idea can serve further usefulness for holding other than round bars, such as hexagonal and others.

Federico Strasser, Stantiago, Chile



Y-Jaw Parallel Clamp Is Welder's Third Hand

Brazing and other gas-welding jobs are definitely two-handed operations. It is for this reason that it is sometimes difficult to position the work as desired unless a fixture for that purpose is first made.

The contrivance shown has filled this bill and is in frequent use in our shop. It consists of two Y-shaped plates, sawed out on the bandsaw from steel plate. The kind of steel used is a matter of personal judgement; its rigidity is more important. It should be of sufficient thickness to withstand a good deal of pressure without giving way.

The jaws are brazed or arc-welded to a husky parallel clamp. This is best done by first stacking the two Y-plates to align them. The parallel clamp is then closed on the plates after it has been located central and parallel with the Y-jaws. Each beam of the clamp is then welded to its respective plate.

Robert Hill, Columbus, Ohio

CHARLES H WILLEY

Penacook, NH

won $25 in addition to regular payment for his idea:

CLEAN HOLES DRILLED IN RUBBER

in the Aug 12, 1957 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

Our annual Production Planbook will reprint all winning ideas as a review. One will be chosen out of this issue as a winner of winners, and will receive a

GRAND PRIZE OF $100.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.

American Machinist

SPECIAL REPORT NO. 451

the IMPACT of AUTOMATION

a 9-year evaluation

Nine years ago today the word "automation" appeared in print for the first time. Millions of words have been written and spoken on the subject since. Automation has been hailed and damned, adopted and abandoned, applied intelligently and totally misunderstood — it has even been investigated by Congress.

American Machinist was responsible for the first publication of Del Harder's word and has since published more information on detailed applications in metalworking than any other magazine.

How much automation is there today? More basically, what is automation? Does the word really mean anything or is it just a catchword?

This Special Report provides a broad evaluation of automation today. It is based on our nine years' experience in reporting the subject, on a special survey of the metalworking industries, and on scores of interviews with men in industry.

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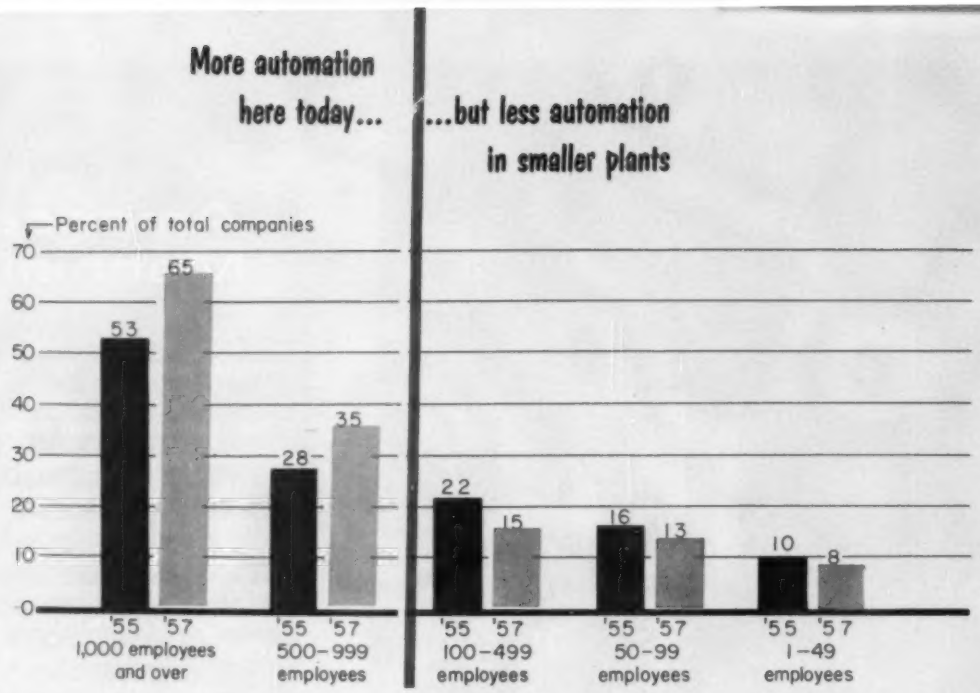
330 W. 42nd ST., NY 36, NY

BY THE EDITORS OF American Machinist

October 21, 1957

The IMPACT of AUTOMATION



How much automation today?

Four out of five people in metalworking today work in plants where there is automation. An average of 19% of the companies use some automation, but they employ 79% of the workers in metalworking.

(These statistics, and all others in this report, are based on a just-completed study on the impact of automation. Answers to many questions were obtained from companies that total 10% of the metalworking industries, in terms of employees.)

It is a safe guess that many of these people are unaware that they are using automation. By the same token, many others may think they are working with automation, when actually what they have is a high degree of mechanization. There is a difference, as will be seen later in this report.

The pattern of automation is far from uniform across the metalworking industries. If we look at each industry in terms of the number of *companies* that have applied automation, we find that office machinery leads with 46%. The auto and electrical industries are in a tie for second with 34%.

But if we look at the number of *employees* who work for companies that have applied automation, then the auto industry leads with 99% and office machinery is a close second with 98%.

The tables at left and right list the top ten industries by each of these methods of calculation. It is ironical to note that the industry that produces metalworking machinery—and hence builds most of the automation devices—is unable to use its own product. Less than 1% of the companies in this industry have been able to adopt automation.

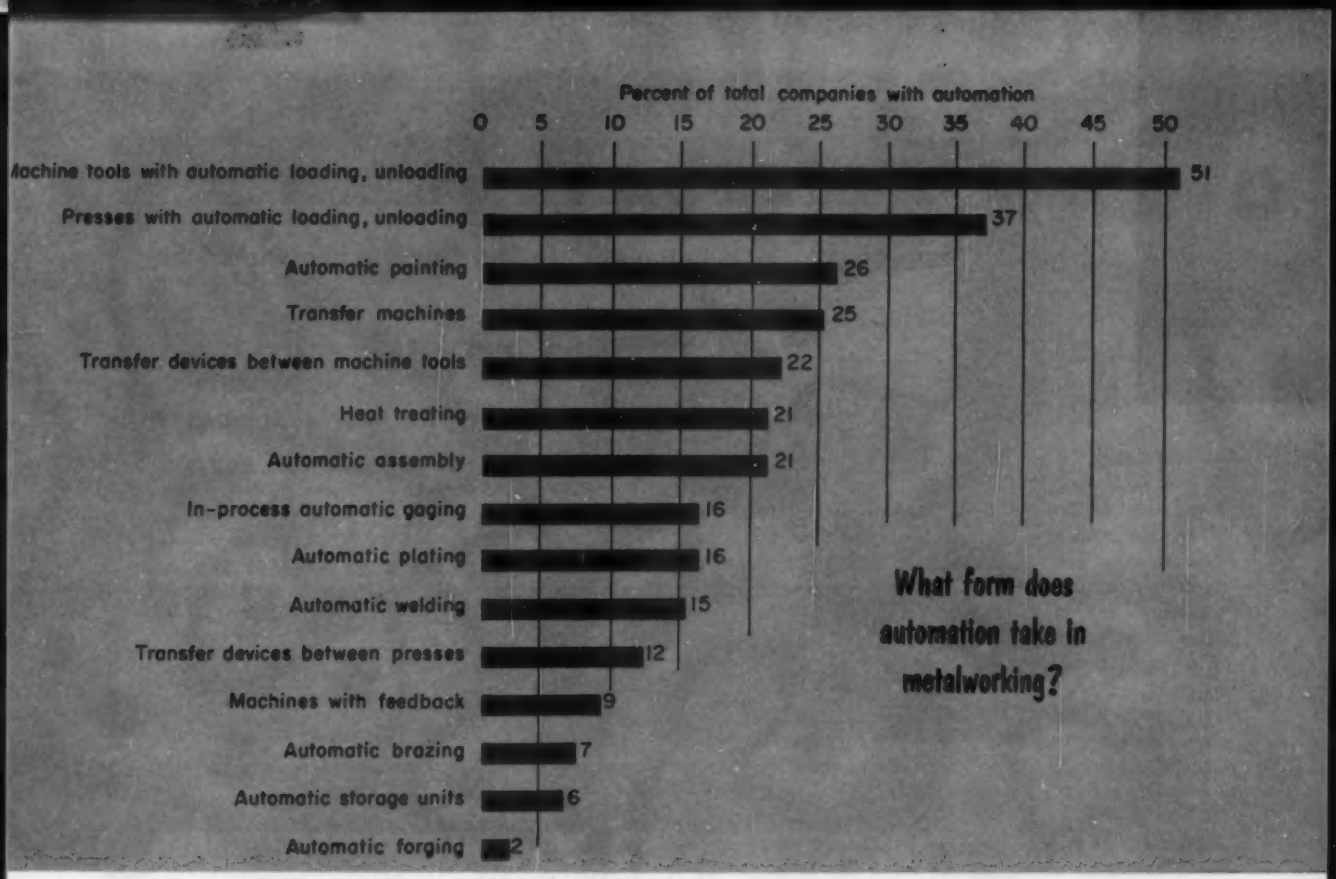
Here are the forms that automation takes in metalworking:

Machine tools with automatic loading and unloading. This is the most common form of automation, found in 51% of the companies that have some form of automation. The range is from 60% in the largest companies down to 43% in the smallest. The greatest concentration, by industry, is in the production of general industrial equipment (83%) and special industry machinery (80%). The makers of miscellaneous machine parts (such as bearings and gears) also rate high (78%).

Transfer devices between machine tools. A more advanced form of automation, that can only be used

The Top Ten by Company

RANK	INDUSTRY	% OF COMPANIES WITH AUTOMATION
1.	Office and Store Machines	46%
2.	Motor Vehicles and Parts	34
3.	Electrical Equipment	34
4.	Fabricated Metal Products	29
5.	Precision Mechanisms	26
6.	Misc Machine Parts	22
7.	Railroad, Shipbuilding, Misc	17
8.	Domestic and Service Equipment	15
9.	Agricultural Machinery	12
10.	Aircraft and Parts	11



after automatic loading and unloading has been applied, these transfer devices are used by 22% of the companies with some form of automation. The heavy users of automatic loading use the transfer devices to a lesser extent, but some of the industries that use less automatic loading, such as the precision instrument makers (50%), auto industry (45%), and the appliance industry (33%), use transfer devices as often as they use loaders.

Transfer machines are found in 25% of the companies with some form of automation, ranging from 47% in the largest plants to 9% in the smallest. The appliance industry is the biggest user at 67%, with the auto industry next at 55%, and precision instruments third at 50%.

Presses with automatic loading and unloading are found in 37% of the automated plants, ranging from 47% of the largest to 26% of the smallest. The heaviest concentration is found in precision mechanisms (67%), with office machinery second (60%) and the electrical industry third (50%).

Transfer devices between presses are found in 12% of the automated companies, ranging from 23% in the largest plants to 4% in the smallest. The heaviest concentration was reported in the appliance (67%) and auto industries (55%), with companies in both industries stating they used the transfer devices when they didn't have automatic press loaders.

In-process automatic gaging is fairly common in the largest plants (37% of those with automation), but relatively rare in all other size groups, so that the average for all plants drops to 16%. The greatest application is reported by general industrial equipment (50%) and by the automobile industry (36%).

Feedback is found in 20% of the largest plants, 4% of the smallest, and 9% of the plants of all sizes.

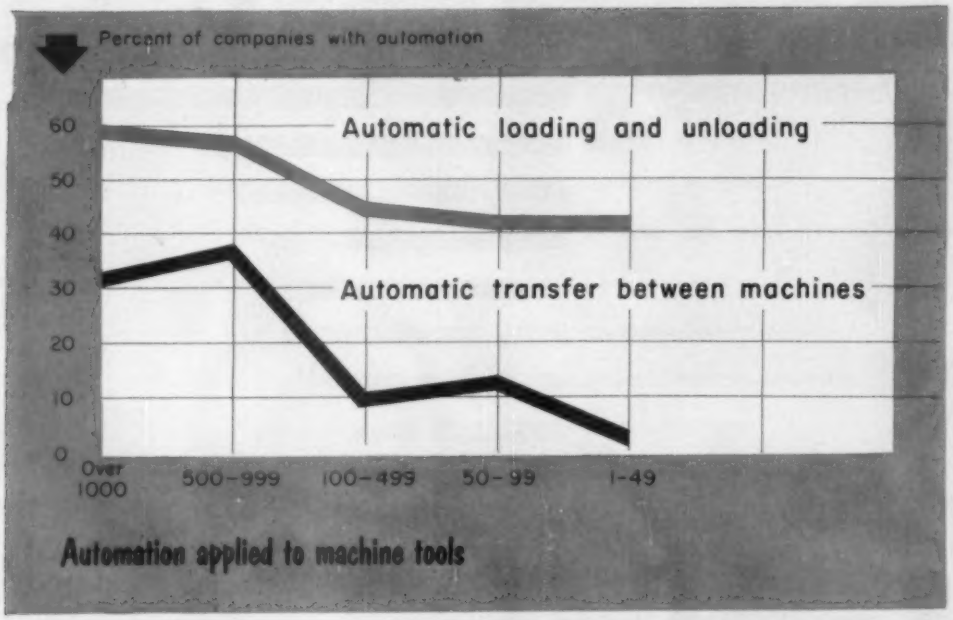
Automatic in-process storage units, one of the newer creations of automation, are found in 15% of the largest plants, but almost nowhere in companies with fewer than 1000 employees.

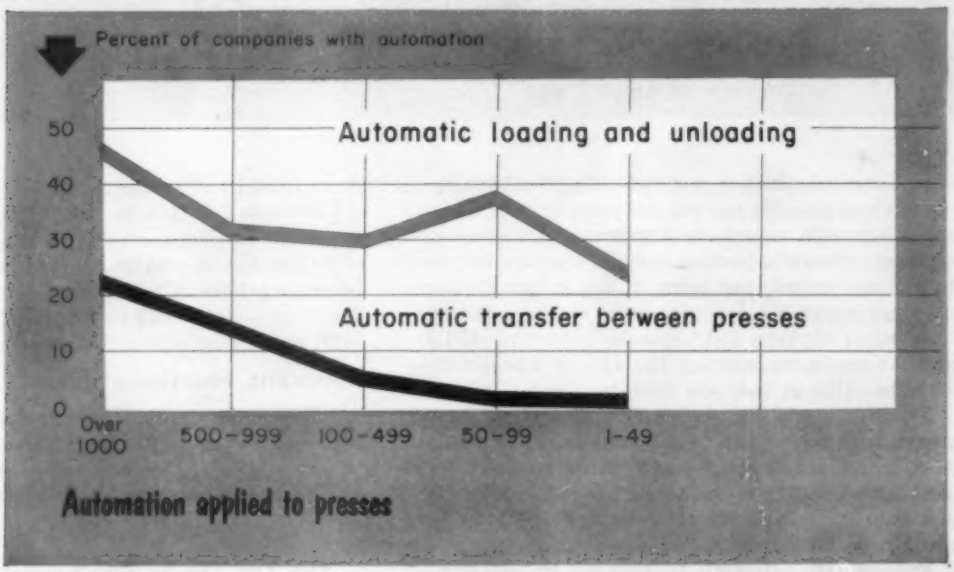
AUTOMATIC PROCESSING LINES

Painting lines are the process operation most often automated in metalworking. They are found in 26% of the plants with some form of automation. They are naturally most common in the auto industry

The Top Ten by Employment

RANK	INDUSTRY	% OF WORKERS IN COMPANIES WITH SOME AUTOMATION
1.	Motor Vehicles and Parts	99%
2.	Office and Store Machines	98
3.	Electrical Equipment	91
4.	Precision Mechanisms	85
5.	Misc Machine Parts	76
6.	Fabricated Metal Products	75
7.	Domestic and Service Equipment	62
8.	General Industrial Equipment	51
9.	Aircraft and Parts	49
10.	Special Industry Machinery	46





(64%) but are found in 40% of the companies making office machines.

Heat-treating lines are found in automated form in 21% of the plants. Although they are most common in the largest plants, they are found quite often in the smaller ones.

Automatic assembly is also reported by 21% of the plants with some form of automation. Here the relationship to size is clear-cut with 38% of the largest plants and none of the smallest group using automatic assembly.

Plating lines were found in 16% of the automated plants; 33% of the largest size group down to none in the smallest. Builders of office machinery (40%) and precision mechanisms (33%) were the most frequent users.

Welding lines have been automated in 15% of the plants having some form of automation. Here the auto industry and the aircraft industry led in the application.

Brazing lines have been automated in 7% of the automated plants.

Forging lines have been automated in 2% of the plants that have automation in some form.

These are the specific forms of automation that could be measured in our survey. Much additional modernization is loosely called automation but can't be measured in precise precentages.

What is automation?

"Automation is a dirty word."

"Automation is a second industrial revolution."

"The word automation has caused much confusion and misunderstanding."

"Automation is the next logical step in a slow evolution."

"The only new concept involved is the word itself."

"We think it is time that publications such as *American Machinist* begin to use more than catchwords to describe the growth and potentials of various methods of utilizing advanced techniques in manufacturing."

All right, what *is* automation?

Because the word appeared in print first in this magazine,* the editors have always had a special interest in it in addition to their normal interest in all aspects of metalworking production. We have published millions of words on the subject, mostly concerned with the details of specific applications. As the actual quotes above indicate, there is still some disagreement about automation. It was just ten years ago that the word was coined; it was just nine years ago today that the word was exposed to public view. It seems time for a comprehensive look at the whole broad field of automation: an objective analyis of where it came from, where it stands today, and where it is going.

THE WORD ITSELF

There can no longer be any argument about the origin of the word. It was coined just ten years ago by D S Harder of the Ford Motor Co. Credit has occasionally been given to others, but it is now clearly established that other uses of the word arose some years after Mr Harder had applied the name to a special task force at Ford.

A study of the subject by the editors of Merriam-Webster's dictionary has given *American Machinist* the credit (or the blame) for being first to use the word publicly. After that first use, we employed the word occasionally and about four years later it was used in a book by John Diebold. At that time (1952) the word began to be encountered frequently in the technical press. Another two or three years and it was in every newspaper and popular magazine. This phase of public excitement culminated in a Congressional hearing in 1955.

*"Ford Handles by Automation," by Rupert Le Grand, *AM*—Oct 21 '48, pp 107-122.

That much of the history of the word is easy, but what does it mean? In our first Special Report on the subject, automation was defined as "the art of applying mechanical devices to manipulate workpieces into and out of equipment, turn parts between operations, remove scrap and to perform these tasks in timed sequence with the production equipment so that the line can be wholly or partially under pushbutton control at strategic stations."

So far all was clear. The Ford task force was working primarily on the automation of press operations. When the effort was turned to engine manufacture, and produced the first Cleveland Engine Plant (*AM*—Mar 17 '52, p135), the definition was still a good fit for the application.

But then the use of the word began to spread and its meaning began to evolve (some feel that it began to disintegrate). Del Harder has since said that automation is a "philosophy of manufacturing" and that the definition must be broadened to include design of parts, methods for their manufacture, and production-tool control systems.

Because the word had such a close connection with Ford initially, there was a recognizable distaste for the word automation on the part of the other automobile companies. At one time there was a flat rule against the use of the word within one company. As the use of the word has grown more general, so that it is applied more often today outside the auto industry than in it, provincial or childish objections have diminished.

Then a new opponent to the word arose. Automation was discovered by the labor unions and became a shibboleth comparable to "capitalist."

The word has come under attack from another quarter, too: those who resent the implication that all automaticity started in 1947. C W Simpson of National Acme cites the first 4-spindle automatic built by his company in 1893. The principles embodied in that machine became the prototype for today's multiple-spindle machines.

"The continued use of this word automation," say E P Gillane and J J Jaeger, of Pratt & Whitney Co, "with the ever-lingering thought that it means Detroit-style mass-production transfer-type machines and the implication that this is something that has happened recently and is not the result of the normal evolution of machine design and manufacturing techniques does not contribute to the overall understanding of labor and management."

Certainly most production men recognize that

better and cheaper methods have come gradually as the sum of many individual accomplishments. Milestones on this road would include interchangeable parts, high-speed steel, standardization, carbides, and a host of individual developments in machine tools, gages, and handling equipment. The development of the automatic screw machine at Brown & Sharpe during the Civil War is only one of the steps in that sequence.

Does automation represent anything more than a continuation of this technological advance, or what is sometimes glibly called the "annual improvement factor"?

Yes, it does.

You can mechanize a single machine to the point that it is completely automatic and still not have automation. Automation comes when you take a group of related operations and tie them together mechanically with the necessary interlocks and controls to provide continuous automatic production.

NEW WORD JUSTIFIED

This step introduces a new element, one which justifies the use of a new word. It does not mean that you must have the mythical "push-button factory" to achieve automation. Whenever you combine operations with mechanized handling and control you have automated that part of your operations. The elements *continuous* and *automatic* should both be present, however, if true automation is to be distinguished from mechanization.

When two or more machining operations are combined on a standard machine, is that automation? If it is, then all automatic bar machines, vertical turret lathes, and many other types are prime examples of this "new" science.

Most people, except the builders of those machines, will agree that it is not. Automation comes when the bar machine is tied mechanically to the source of bars that precedes it or to the conveyor system that takes parts beyond it—in short, when two or more automatic machines are tied together automatically.

Here is a harder case to classify: Ross Gear & Tool uses 8-spindle Conomatics with a Tocco induction-hardening operation built into two of the stations (*AM*—Sept 24 '56, p124). Here two totally unrelated operations (turning and heat treating) are built into the framework of a standard machine. The saving in time is immense (the total cycle was cut from three weeks to four hours), but is it mechanization or automation? If our definition is not to collapse, we must say that it is an extremely ingenious and profitable example of mechanization. It is not automation.

Then what about the transfer machine? Is there any basic difference between an 8-station automatic and a 96-station straight-line transfer machine? There is this difference: The transfer machine is essentially a group of separate machines that are mounted on a bed whose function is primarily material handling and control. Not only the tooling at a station, but the entire machine section at that station, can be removed from the line and be modified or replaced.

This approach will apply neatly to all the other operations encountered in metalworking production, and the techniques are similar whether you are automating a line of machines or a line of plating tanks.

Automation, then, is the melding of production operations with handling and control operations to tie separate pieces of automatic equipment into continuous automatic production through a series of operations, an entire line, or a complete plant.

HOW AUTOMATION BEGAN

If we accept this definition of the word automation (and there is growing evidence that it will become the generally accepted meaning), the next logical question is: Did automation begin in 1947 at Ford?

No, it did not.

One of the earliest attempts to tie separate operations together was Oliver Evans' now-famous grist mill, designed in the 1780's in Philadelphia. This concept was applied to many other industries before it came to Metalworking.

But it came to the metalworking industries earlier than many realize. Ford set the pattern with the assembly line in 1913; though there was little real automation in that line, it did establish a way of manufacturing (the product line rather than the processing department) that made automation possible.

The first real automation was in the automatic frame plant designed and built by A O Smith Corp. This plant began operation in 1920 and was so soundly designed that it is still in profitable operation today.

Transfer machines are almost as old. The first true transfer machine appears to be the one built at the Morris automobile plant in Coventry, England, in 1924.

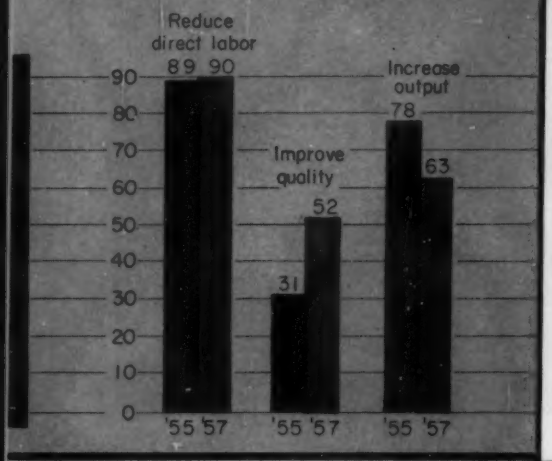
Transfer devices between machines were applied at Graham-Paige in 1929.

These are landmarks on a long, gradual road to continuous automatic production. What Del Harder did with the word automation was to give a name to a concept that already existed. A word was needed to distinguish these efforts from mechanization.

The birth of the word coincided with a period in which there began a startling acceleration of the rate at which automation was applied. We can never know whether or not this was a coincidence, but it is reasonable to assume that at least some of the rate increase was due to a word that captured the imagination of engineer and layman alike.

Thus, despite the dislike of the word in many quarters, every production man who has tried to sell his management on the purchase of high-production equipment, and every equipment builder who has tried to sell a reluctant customer should have cause to be grateful for a catchword that has made the aim of much modern equipment clear to conservative comptrollers.

The changing reasons for automation...



Why automated equipment was installed

SIZE OF COMPANY	TO REDUCE DIRECT-LABOR COSTS	TO INCREASE OUTPUT	TO IMPROVE PRODUCT QUALITY	TO MEET A LABOR SHORTAGE
1000 employees and over	95%	65%	75%	33%
500-999 employees	96	71	37	4
100-499 employees	86	59	41	0
50-99 employees	96	64	46	0
1-49 employees	69	56	35	17
TOTAL	90%	63%	52%	4%

Why does a company try automation?

The finger was probably put on the real reason for much automation in a revealing case study, though a mythical one, once presented at a meeting of the Society of Automotive Engineers (*AM*—Jan 30 '56, p125).

In that case, the management was forced by competition to adopt automation. The plant had reached the point where volume alone would not reduce costs "as long as we have high maintenance costs and low productivity because of outmoded machines and methods."

The principal reason given by companies today is to reduce direct-labor costs. This reason is cited by 90% of all companies with automation, and by more than 95% of those with more than 1000 employees. Lurking behind this reason in nearly every case is a competitor and the harsh necessity to try to meet rising labor costs, at least in part, by an increase in the productivity of direct labor.

Related to this also is a reason given by 63% of the companies: to increase output. Usually it means to increase output without having to build new facilities.

As Donald C Burnham of Westinghouse Electric put it to us: "Automation builds up plant capacities and, as business grows—which it is rapidly doing—more and more automatic equipment will be bought. Because higher volume is achieved in less area, it is practical to spend money for machines rather than buildings."

At Timken's Bucyrus plant, 30 million bearings a year are produced in 180,000 sq ft and the bearings sell for 15% less than comparable sizes made without the blessings of automation.

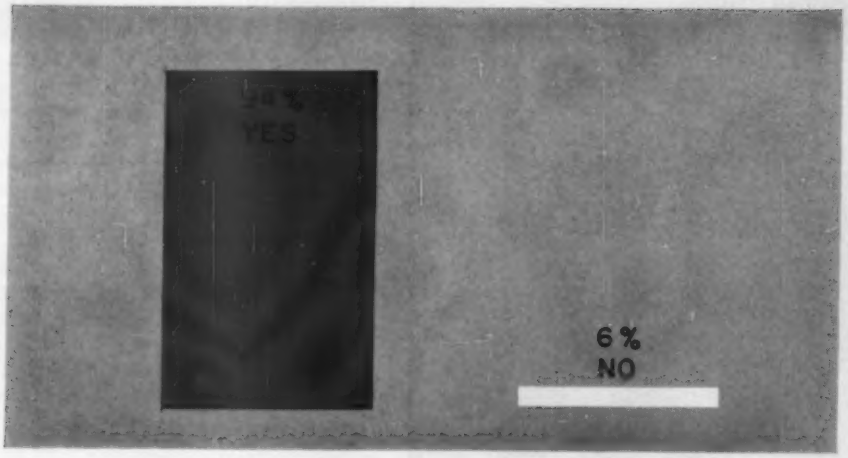
GROWING NEED FOR QUALITY

Today a much greater percentage of companies than in 1955 state that they installed automation to improve product quality. This percentage increase represents the most striking change in reasons for using automation since the 1955 report; in the largest companies the number giving this reason jumped from 39% in 1955 to 65% in 1957, more than half the companies in all size groups indicating that they adopted automation in their plant to improve product quality.

Initially, this was a rare reason for trying automation, but experience soon proved that quality improvement was one of the major benefits. Many companies have had increasing difficulty in building and maintaining product quality in today's labor markets and are turning to automation as a way to put the quality in by machines instead of by the skill of the operators.

THE IMPACT of AUTOMATION

Has automation lived up to expectations?



How successful is automation?

Among all the companies in metalworking included in our survey, nearly everybody reported that the automation installed had provided the performance that was expected of it.

Among the 6% who had been disappointed in the results, the trouble could be summed up in one word: "bugs." As one man put it, "Too many tricky electronic problems and no trained or capable mechanics to whip them." This company hasn't given up, however, and is "still hoping."

Another company puts the blame for its dissatisfaction on the builders who designed the equipment. "Without fail," an officer of this company said, "they have been over-optimistic on machine capacity, have under-estimated total cost, and cost of debugging has been excessive." This company is now having its own equipment designers make the preliminary design with better results.

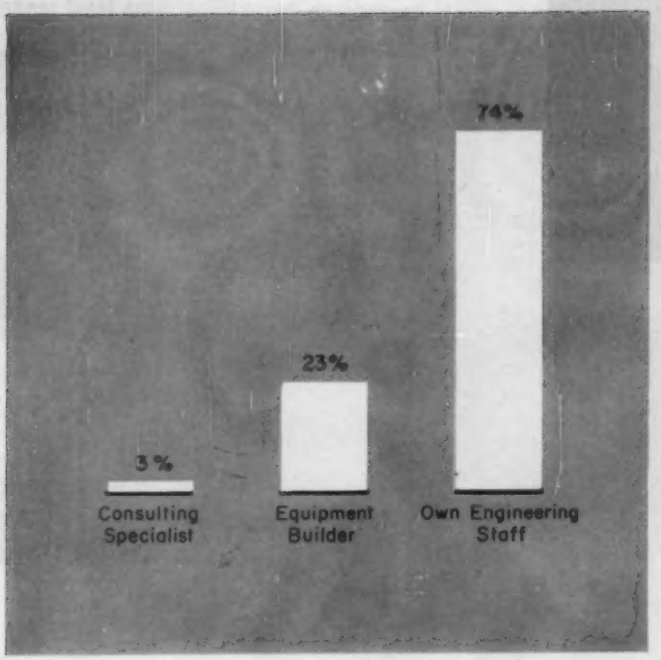
In some cases, difficulty arises from the material worked. A continuous line of machines may fail to give the performance required because of frequent shutdown for tool changes. Such problems may be reduced by changing the material worked, by speeding up tool changes (perhaps making them automatic), or by finding a tool material with better life.

A classic failure of automation is at the Granite City (Ill) frame plant of A O Smith Corp. Ironically, this same company was the one that built the original automated frame plant in 1920. A report on this $4 million line that failed appeared in *Business Week*, August 10 '57, p58. Most of the trouble with the line can be charged to a lack of time. As one engineer put it, "We tried to do in one year what should have taken three." By the time the bugs were out and some of the other problems involved were on their way to solution, the line was only able to run four months before design changes on auto frames would have required a $2-million retooling job, so the line was shut down.

Among the 94% of the companies that say they have been satisfied with automation, there has often been trouble with bugs, too. But automation is still relatively new and many of the transfer devices, loading mechanisms, turnover devices, and interlocks that are required must be designed with little or no precedent. Bugs and delays are often the penalty of tackling automation today. On balance, however, nearly 19 out of 20 companies that have tried it find that it pays.

The reason was given by the man who said, "Ultimately the test of any production process is final cost per piece. If an automated line is down 75% of the time because of bugs or lack of work and the final cost per piece is still less than it would be by other methods, the use of automation is justified."

How is automation planned?



Most companies are doing their own planning for automation equipment. About three-fourths use this method primarily, with the balance nearly all relying on the equipment builder for the design work. Only about 3% say they put their planning principally in the hands of consultants.

Bear in mind, though, that we were asking who was *primarily* responsible, and nearly all elaborate installations are likely to be the joint work of both builder and user.

Interesting, and expected, variations occurred from industry to industry. Generally, those parts of metalworking that have adopted automation most extensively tend to do the largest part of the planning themselves. An exception was the group that makes miscellaneous machine parts, with nearly two-thirds relying mostly on equipment builders.

An exception in the other direction was the aircraft industry, where there is relatively little automation as yet, but where every single company replying indicated that it did most of the planning itself.

The most popular basis for deciding whether automation is an economic solution to a particular problem is to require that it pay for itself in savings within two years. Two out of every five companies use this yardstick (see table at right).

The larger the company, the more it can afford to wait, apparently, for the three-year payoff period is slightly more popular as a standard in those companies with more than a thousand employees.

In general, the big companies all stick to a two or three-year standard while the smaller ones are less consistent, with more of them insisting on one year and also more of them accepting payoff periods longer than three years.

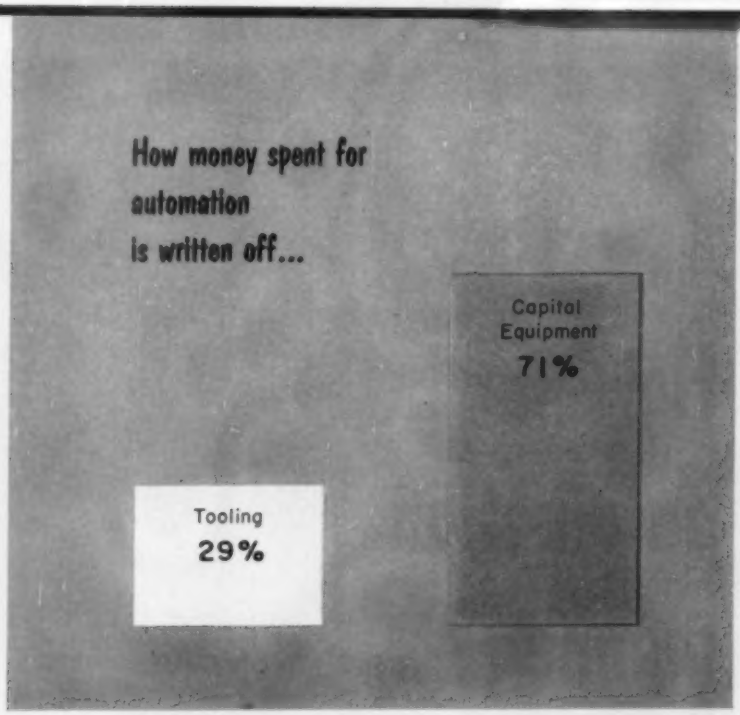
Each company was also asked what portion of the equipment, on the average, was written off as tooling. The average company writes off 29% of the cost as tooling and 71% as capital equipment.

The smaller companies manage to write off a bigger portion as tooling. One factor in this might be a difference in the attitude of the tax investigators toward small and larger businesses. It is more likely, however, that the larger companies tend to spend more of their automation dollar on special machines that must be capitalized.

Most companies plan their own automation

SIZE OF COMPANY	DO-IT-YOURSELF PLANNING	PLANNED BY EQUIPMENT BUILDER	PLANNED BY CONSULTING SPECIALIST
1000 employees and over	68%	28%	4%
500-999 employees	77	19	4
100-499 employees	81	17	2
50-99 employees	82	18	0
1-49 employees	70	26	4
TOTAL	74%	23%	3%

the IMPACT of AUTOMATION



Can automation be

At first, little thought was given to the idea that automation might be flexible. A plant such as Ford's Cleveland Engine Plant could be tooled for one specific engine, require virtual rebuilding when the engine was redesigned, and still be profitable.

This led to some cases in which unanticipated design changes ended in plants filled with white elephants. That in turn has led to a demand for ease of retooling. Of course, the transfer machine is basically flexible by nature—units can be rearranged or rebuilt as required, but sometimes only within the limits of the original maximum part size.

As automation spread to bearing plants and electric motor plants, the need was for quick operating changes to permit the line to produce several sizes of similar parts.

One builder of special machinery estimates that the premium in terms of cost for a flexible machine is likely to run 20%. The extra time to build the machine would also be close to 20% more. Another builder takes the same view, but doesn't feel the premium runs so high.

This is not always true: For the type of equipment that Gisholt builds, for example, F C Chapman reports that flexibility "does not add much of a penalty in terms of either time, space, or cost over a more limited special-purpose machine provided that we realize at the outset that flexibility and ease of change-over are required and carry out engineering accordingly."

In fact, "the special machines and their tooling generally cost a good deal more than a universal, standard machine and tooling because the engineering cost on the standard machine can be spread over more units," says L M Cole of Warner & Swasey in commenting on this point.

Similar experience is reported by Wallace Bainton at Brown & Sharpe, who says that their experience in applying automation to both milling and grinding machines has resulted in adaptations of standard machines that could be quite readily retooled.

This is not true of all standard machine types. As Edgar McFerren of Giddings & Lewis points out, in their case, "It requires a great premium to produce a machine with automatic features which still retains the general-purpose character."

Certainly, however, you have to pay extra for flexibility in special machines. Ralph Cross sums it up this way: "We find that our customers desire more flexible machines, but they are reluctant to tie up any substantial amount of capital for this purpose."

This reaction depends a lot on previous experience. In reporting a day-to-day growth in the demand for flexibility, Chester Johns of Buhr Machine Tool says that customers "seem willing to pay a premium," especially when they have a history of minor changes in their products. "Flexibility in automated equipment allows them subsequent cost reductions

How is automation written off?

SIZE OF COMPANY	% WRITTEN OFF AS TOOLING	% WRITTEN OFF AS CAPITAL EQUIPMENT
1000 employees and over	23%	77%
500-999 employees	19	81
100-499 employees	40	60
50-99 employees	45	55
1-49 employees	35	65
TOTAL	29%	71%

How soon automated equipment is expected to pay for itself

SIZE OF COMPANY	ONE YEAR	TWO YEARS	THREE YEARS	LONGER
1000 employees and over	6%	43%	47%	4%
500-999 employees	17	58	21	4
100-499 employees	25	43	25	7
50-99 employees	38	29	29	4
1-49 employees	16	32	37	15
TOTAL	17%	42%	34%	7%

flexible?

in retooling and gives the machine a longer life potential."

The problem is summed up neatly by F K Jones of Norton when he says, "We have yet to find the 'rubber' design which will permit handling of a wide variety of parts. Most workpieces have to use equipment specifically designed around them and the universal device does not appear to be at hand."

One auto company has asked Norton to provide a loading device divorced from the machine itself so that the machine can operate with or without it.

One of the biggest difficulties with flexibility is the "in-between automation"—the transfer devices, conveyors, and storage units required to tie machines together into a line. In pointing this out, E R Smith, Jr of Seneca Falls Machine says it would perhaps "be the most costly section to change over. Here again, the designing of the part so that it will lend itself to automation is of prime importance."

At the Timken Bucyrus plant (*AM*—Sept 23 '57, p147), it is necessary to replace conveyor sections when changing a line from one part to another. Many sections have to be changed for a part that is about as easy to move as can be found.

In press operations flexibility can be relatively simple because of the standard mounting provisions. Even so, there seems to be some choice, and John F Herkenhoff of Minster Machine reports that "a quick means for reducing set-up time plus low maintenance (backed up by stability for improved die life) can provide better savings than increased productivity."

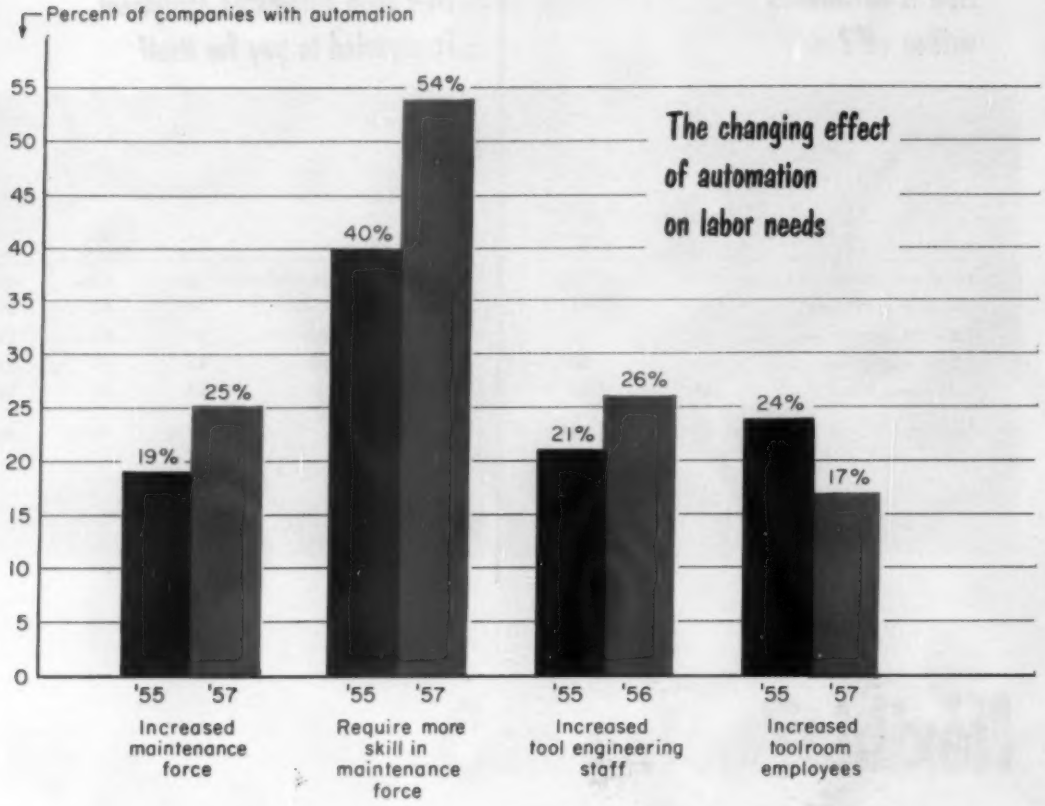
THE "BUILDING BLOCK" CONTROVERSY

A recent element injected into automation is the term "building-block machines." Once again the term came from Ford, and once again it was first reported by this magazine (*AM*—July 16 '56, p113).

Immediately, some builders of special machines pointed out that they have used sectionalized, unit, or "building-block" construction for years.

There is an important difference between the two ideas, however. Ford is thinking in terms of standard building blocks that are interchangeable between makes of machine, along the lines of the standards for presses developed by the Joint Industry Committee. Most of the builders are thinking of building blocks within a specific make of machine.

One view of the building-block approach is expressed by D M Pattison of Motch & Merryweather, who says the idea will grow "even though the user of the machine tool has to return it to the manufacturer's plant for retooling or converting into a machine of different characteristics, yet the time saved and the expense saved will eventually be of tremendous interest to the user." He also feels the idea is beneficial to the machine builder "as it permits the manufacture of standard units and quantities and will cut down the overall lead time both for engineering and manufacturing."



How does automation affect productivity?

One of the most important, and least talked about, factors related to automation is productivity.

As the president of one small company in the East told us, "We went to automation to regain a loss of worker productivity experienced in recent years. Automation has enabled us to increase output per man to acceptable levels. People have not been displaced by our automation devices—the devices are producing the amount of work the men won't give us."

Automation affects productivity in another way, too. Automating part of production often increases productivity of that segment so much that an imbalance with other segments results. One large Midwestern manufacturer reports: "Our efforts in acquiring automated equipment have been directed primarily into fabricating and material-handling areas during the last seven years. Reviewing the results shows that the ratio of assembly to fabricating costs has increased to a significant degree. Our sights are being set to cope with the problems associated with assembly operations because of this fact." By purchasing automated equipment for its assembly operations, the company hopes to reduce the assembly-to-fabricating ratio.

Here a little bit of automation would seem to be a bad thing. Actually, any production improvement is beneficial. In this case the production bottleneck has been shifted to assembly—the next phase to be automated.

"Reduced cost of direct labor" was given as a reason for the installation of automation by 90% of the companies that use it, compared with 89% two years ago. But in the largest companies, this reason

has climbed from 90 to 95% in the past two years.

At the same time the number of plants who installed automation to increase output is declining. From 78% in 1955, it has dropped to 63% this year.

These figures point up the impact on both labor and management of the idea that productivity must continue to rise from year to year if all wage gains are not to be offset by inflation.

The decade that has seen the growth of automation has also seen quite a change in the attitude of the individual unions. As Donald C Burnham of Westinghouse puts it, "Now the unions have an eye on 'the better life' and take an enlightened point of view toward automation. Sometimes they object to changes in methods that affect incentive plans, but they are not opposed to automation in itself."

A striking example of this change in the attitude of labor leaders was provided last month by the president of the New York local of the Amalgamated Lithographers of America, Edward Swayduck. He proposed that the union contribute $1 million to a joint labor-management research fund to promote automation in the industry.

The proposal was made because the union sees automation as the way to lower costs, increase markets, and insure both fair profits to the employers and full employment to workers.

Few union leaders have gone so far in their public recognition of the necessity for automation, but few of them attack automation as such today. They use it rather as a basis for bargaining demands.

Typical of this school of thought is Al J Hayes, of the International Association of Machinists, who says, "We feel that many will try to take advantage of automation for profit We feel that there are some who will not willingly face up to the by-products of automation, who will oppose the adjustments necessary." These adjustments, according to Mr Hayes, are "substantially higher wages, substantially shortened workweeks, substantially lengthened vacations, and retraining to enable those displaced to be reabsorbed by industry."

In the industry most affected by automation so far, planners at the United Auto Workers appear to accept automation as inevitable. Nowhere in the record have they permitted an important slip, such as condoning a strike against a new machine. Their concern lies with the immediate problems of small groups of workers displaced.

Walter Reuther says that major automakers are finding it cheaper to automate and produce their own parts and that not all of the displaced workers drift to the new job source.

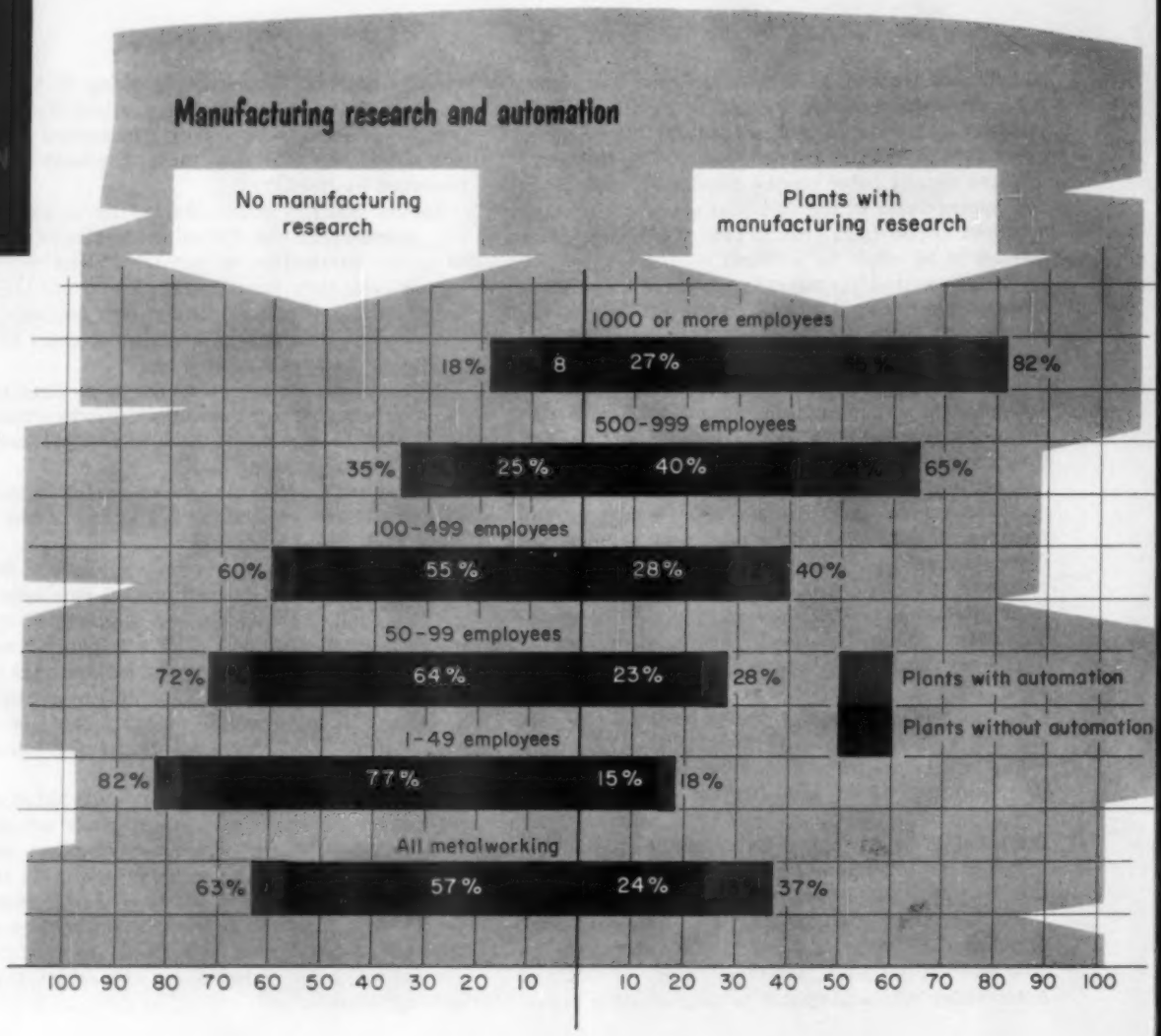
It is hard to find any evidence that these displaced workers exist anywhere except in the imagination of union leaders.

On this point, Ralph Cordiner of General Electric has said that "The factor of normal employee turnover has not been adequately appreciated in most discussions of automation." In the past 12 months, Mr Cordiner said at the automation hearings, "General Electric has hired about 40,000 new employees to replace those who quit, died, retired, or whose employment was terminated for reasons other than lack of work."

Certainly the basic problem today is not displaced workers, which in most labor markets are hard to find, but the finding of people who can produce enough to make a profit at today's costs. In the last year or two wages have increased faster than productivity and costs have gone up faster than selling prices. This has created a squeeze on profits for many companies that is intensifying the search for cost-cutting ideas.

How automation affects employment

size of company	MACHINE OPERATORS: Need More Skill	MACHINE OPERATORS: Need Less Skill	MAINTENANCE FORCE: Increased in size	MAINTENANCE FORCE: Increased in skill	Increased tool engineering staff	Increase in toolroom employees	Increase in setup force
1000 employees and over	23%	43%	30%	65%	40%	17%	25%
500-999 employees	29	33	29	50	29	21	13
100-499 employees	34	45	25	57	23	18	7
50-99 employees	25	43	21	54	11	21	14
1-49 employees	26	48	13	26	9	9	4
TOTAL	27%	43%	25%	54%	26%	17%	15%



Will research lead to automation?

The idea of research in manufacturing methods—a formal attempt to find a better and cheaper way to make the product, or in some cases just to find a practical way to make it—probably got its start in the aircraft industry. Now it has spread to all divisions of metalworking and to companies of all sizes.

Research of this type should not be confused with the larger volume of research conducted to develop new products or to improve existing ones. But manufacturing research has an importance to production men out of all proportion to the amount of money spent on it, because many of the new methods and the ideas for new equipment come from this source rather than from the research and development conducted by equipment builders.

As would be expected, the bulk of the research is conducted by the largest companies, and generally coincides with an emphasis on automation. The average company that does any manufacturing research at all has 6.2 people on the job and will spend $48,500 this year for this purpose.

In the companies with more than a thousand employees, the average is 17.3 people with an average expense for research in production methods of $158,000. Altogether, over a third of the companies reported in the survey (37%) are doing some manufacturing research. The total that will be spent by the 237 companies that would make an estimate for this year is more than $11.5 million.

Even more noteworthy is that next year these companies expect to spend 22% more on manufacturing research than they are spending in 1957. The logical conclusion is that a good part of this research will go into ways to automate production.

What is the future of automation?

A real clue to the future of automation is provided by examining the attitudes of production men when they are planning to buy new equipment. Do they still think in terms of standard equipment first, or do they look for a mechanized approach in the early stages of their planning?

The new *American Machinist* survey shows that 27% of the money spent for new machines during the next year will be for automated equipment. Understandably, the companies that now are using automation are the ones that plan the heaviest expenditures. Those that have some automation now have earmarked 40% of capital funds for automated machines while only a tenth as much has been allocated for this purpose in the remaining plants.

Almost the same relationship holds for all the other types of shop equipment required by Metalworking. The plants that are now automated to some extent expect 41% of the money to go for automated handling and processing equipment; the others expect to spend 4%.

Better understanding of these statistics comes when you talk with the builders of equipment. One company that builds special machinery reports that at best 95% of requests for quotations are of the automation type, whether large or small.

In the same view, Chester Johns of Buhr Machine Tool says, "Although final decisions may not involve highly automated machinery, the initial considerations are based on the use of as much automation as is practical."

"Machine tools equipped with carbide and ceramic cutting tools have reduced actual machining time to the point where it is necessary to find further savings in other areas," says Burnell A Gustafson of Sundstrand. "All of our customers are considering automatic work handling for further savings to the degree that their products are adaptable."

Among buyers of special machinery, according to H N Maynard of Snyder Tool & Engineering, the demand is for "automatic part handling, in-process gaging to control part quality, automatic foolproof controls and even automatic assembly in connection with some machining operations. How much they want and how much they end up buying, however, is a matter of cost and our customers are very cost-conscious today."

At Jones & Lamson, Howard Finch reports that the "larger customers are definitely interested in any form of automation *which can be justified economically,*" and generally in proportion to the volume of production.

This relationship between volume and interest doesn't always hold. "Even the small job shop is

Planned investment in automation

SIZE OF COMPANY	MACHINE TOOLS (CUTTING AND FORMING) TOTAL EXPENDITURE MILLION $	MACHINE TOOLS (CUTTING AND FORMING) PERCENT FOR AUTOMATED EQUIPMENT	OTHER PRODUCTION EQUIPMENT TOTAL EXPENDITURE MILLION $	OTHER PRODUCTION EQUIPMENT PERCENT FOR AUTOMATED EQUIPMENT
1000 Employees and over	$70.3	36%	$26.5	32%
500-999 employees	9.4	14	4.1	21
100-499 employees	17.4	8	3.6	8
50-99 employees	4.6	7	1.2	9
1-49 employees	3.7	7	0.4	3
TOTAL	$105.4	27%	$35.8	28%

(Data represent reports from 10% of Metalworking)

The Top Ten By Planned Expenditure

RANK	INDUSTRY	% OF PLANNED EXPENDITURE FOR AUTOMATED MACHINES*
1.	Motor Vehicles and Parts	57%
2.	Precision Mechanisms	43
3.	Misc Machine Parts	41
4.	Electrical Equipment	34
5.	Railroad, Shipbuilding, and Misc	33
6.	Fabricated Metal Products	32
7.	Metalworking Machinery	15
8.	Construction, Mining, Oil-Well Equip	10
9.	General Industrial Equipment	10
10.	Domestic and Service Equipment	10

*This percentage is the anticipated portion of capital expenditures that will be for automated equipment in those companies that now have some automation.

receptive to degrees of automaticity appropriate to that level of production," says another company. "Automatic loading and unloading, automatic parts handling—even automatic assembly—are found in some of the smaller plants."

This view is summed up by Don Connor of Micromatic Hone when he says, "Everyone is looking for methods of reducing costs, and with steadily rising labor rates, minimizing the human effort required seems to be one way of doing it. I would say that this is one of the biggest considerations encountered today."

A somewhat different reason for seeking automation is reported by Edgar McFerren when he says the customer is usually seeking "a way to perform the work without the services of a highly skilled operator. Units which we sell normally require skilled operators. Since these skilled operators are difficult to hire, many of the purchasers seek to circumvent this requirement. We find that a great percentage of the customers who are interested in automation on their first inquiry eventually decide against the feature when they are confronted with the cost."

It does not follow that all this interest is soundly based. A sensible warning is offered by E R Smith, Jr, when he points to his experience that fully 60% of the inquiries include a line at the bottom stating: "Also please quote automation." Obviously, as Mr. Smith points out, "the application of automation to closed-cycle machine tools cannot be just an afterthought such as this, but rather must be a full-fledged cooperation between the purchaser and the builder so that the least costly type of automation can be utilized. We all have a lot to learn about automation application engineering before a satisfactory job can be done."

THE LAST WORD

Automation is here to stay and it is going to increase. It seems to be inextricably tied up with the urgent need to increase productivity. As Ralph Cross says, "We will only be able to raise our standard of living by increasing our basic capacity to produce."

Productivity is the best means to lower production costs to meet the challenge of competitors, to satisfy the growing needs of the consumer, to beat inflation, and to provide the nation with adequate defensive power, Del Harder said recently.

That is a heavy demand placed on productivity. There can be no way for productivity to fill that order without better machinery and equipment. And in most cases, that means more automation.

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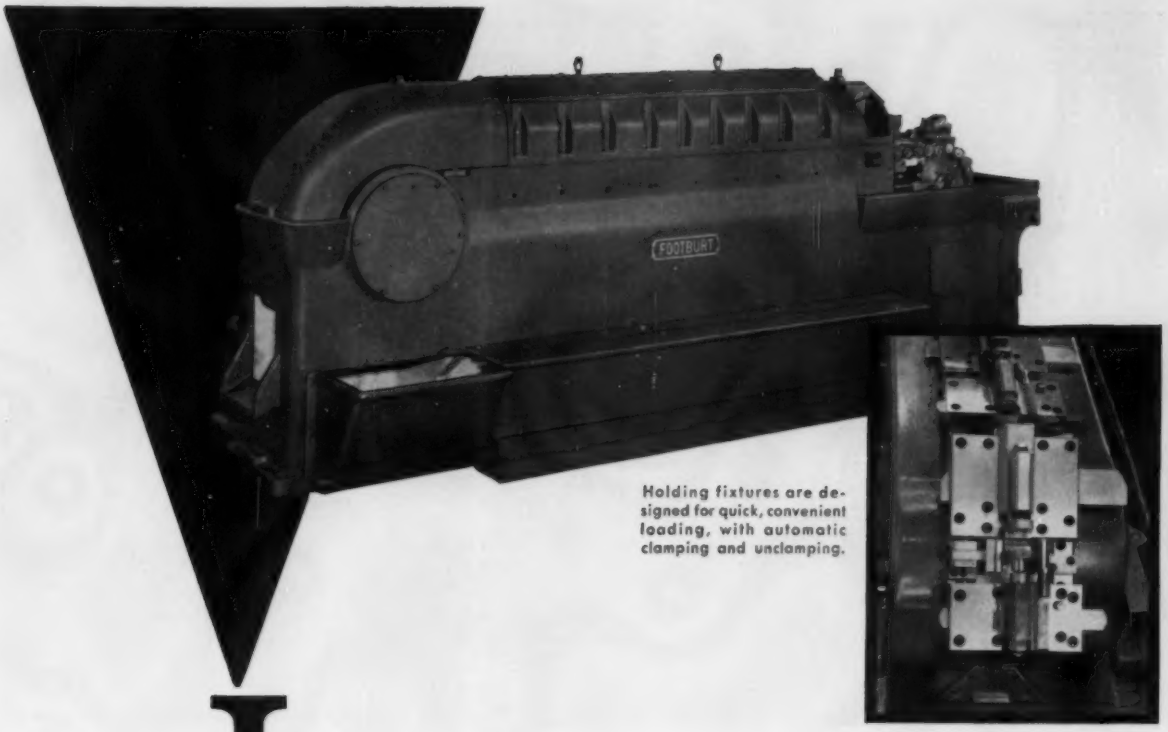

Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

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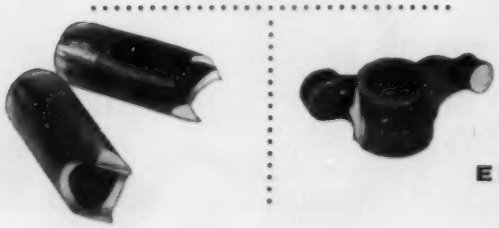

In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching, in many fields.

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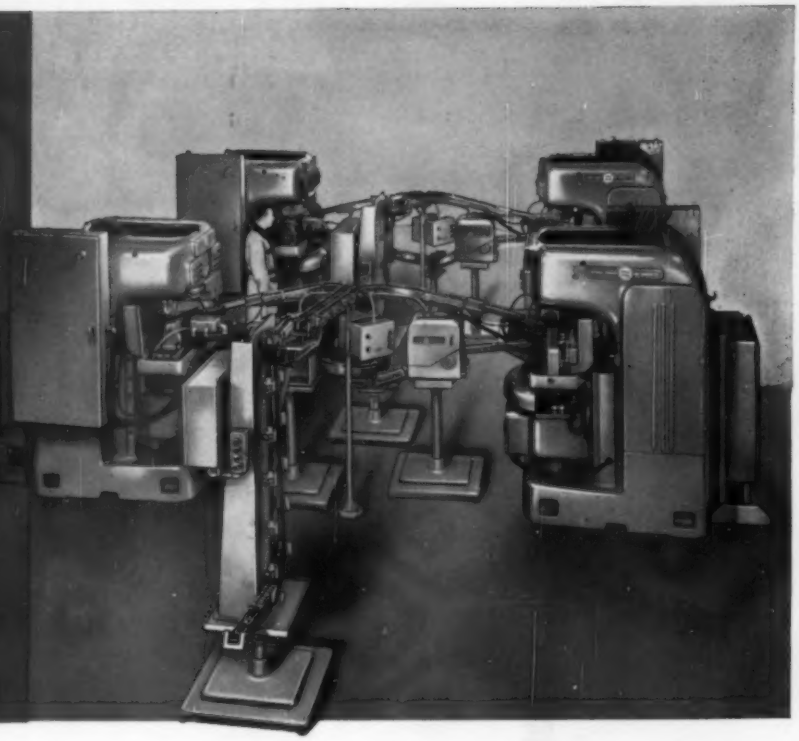

This fully automated installation shaves the split long pinion used in automatic transmissions. This pinion consists of two gear sections each of which is individually crown shaved. Output at full efficiency is 400 pinions (800 gear sections per hour).

The first pair of standard Red Ring Shaving machines processes one of the pinion sections. The second pair processes the other.

Automatic sizing gages perform a 100% check and reject any out-of-tolerance units.

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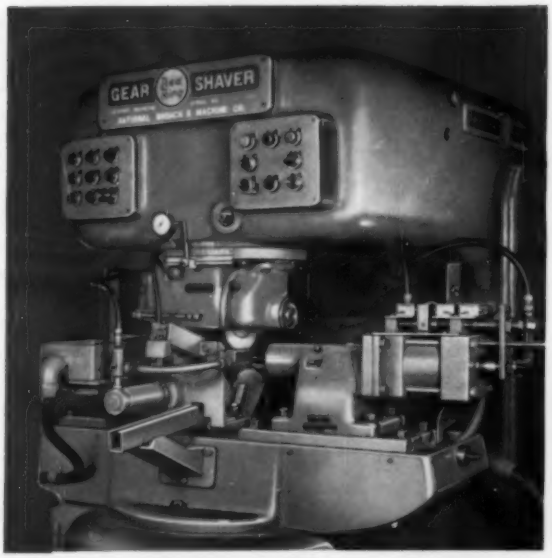
The flexibility of the supply and discharge lines greatly facilitate positioning the machines.



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How to Check Surface Plates . . I

ARNOLD W YOUNG, engineer, ENGIS EQUIPMENT CO, CHICAGO, ILLINOIS

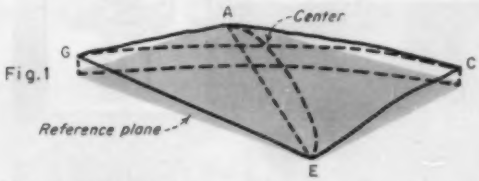


Fig. 1

FIG. 1—Tolerance of a surface is expressed as deviations from true straight lines drawn in a convenient reference plane

Specifications for Tolerance

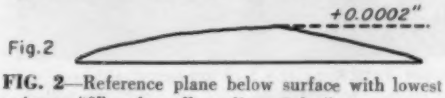


Fig. 2

FIG. 2—Reference plane below surface with lowest point at "0" makes all readings "plus"

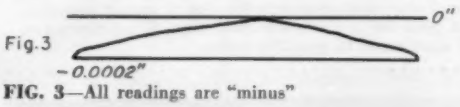


Fig. 3

FIG. 3—All readings are "minus"

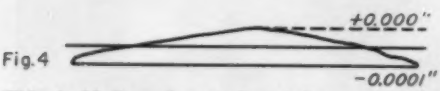


Fig. 4

FIG. 4—Median reference plane makes extreme plus or minus readings equal

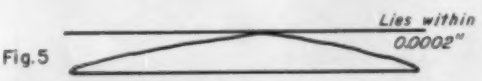


Fig. 5

FIG. 5—Two reference planes, at highest and lowest points, show entire surface lying between them.

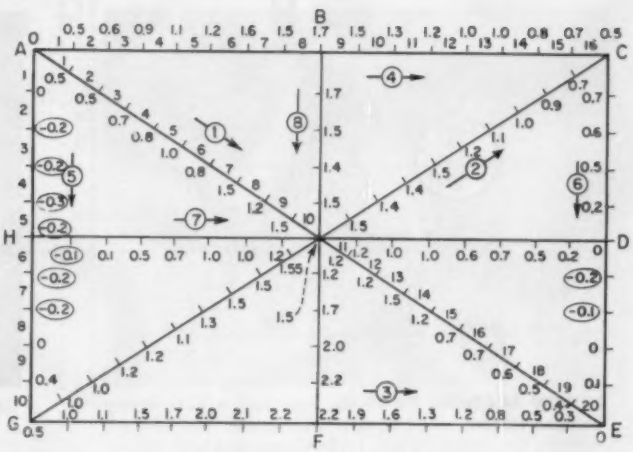


FIG. 6—Typical contour map of a surface plate

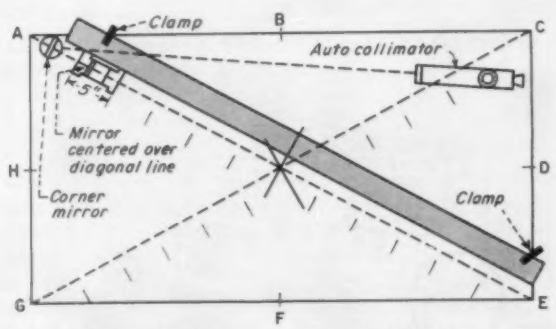


FIG. 7—Optical-equipment setup to take successive height readings at stations along diagonal *AE*

Deviations from flatness of a surface plate, machine table or other precision surface can be expressed in the form of a "contour map." Unlike a topographical map, the contour plot of a surface plate indicates deviations from a reference plane at stations along the diagonals, the two centerlines, and the borderlines. These deviations may be expressed in 0.0001-in. increments.

To establish a reference plane, Fig. 1, a plot of the contour is made along one diagonal, *AE*. The endpoints *O* are contained in this plane. Deviations from flatness at stations along the other diagonal *GC*, and likewise along the two centerlines and the borderlines are made by adjusting the actual measurements at the stations to this plane.

Manufacturers of surface plates calibrate their products to a particular system. It is a good practice to follow the system the manufacturer used for specifying deviations (see Figs. 2 to 5), when rechecking the flatness of surface plates in your plant.

There are various devices for checking flatness of a surface, but optical methods are the most precise. For this work you will need an autocollimator, a corner mirror, a reflecting mirror, a straightedge, colored crayon and pencils, and plotting paper. The procedure for producing the contour map, Fig. 6, is:

1. Clean the surface plate according to the manufacturer's instructions.

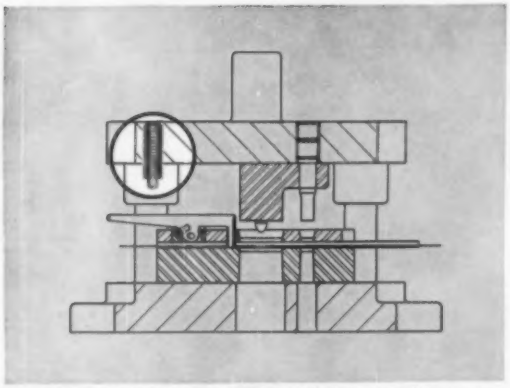
2. Lay the straightedge along diagonal *AE* of the surface plate, as in Fig. 7, and mark stations with chalk. A 5-in. spacing is appropriate. Do not draw a diagonal line, because this is the path of movement of the reflecting mirror, and errors could be introduced.

3. Back off the straightedge from the diagonal by one-half the width

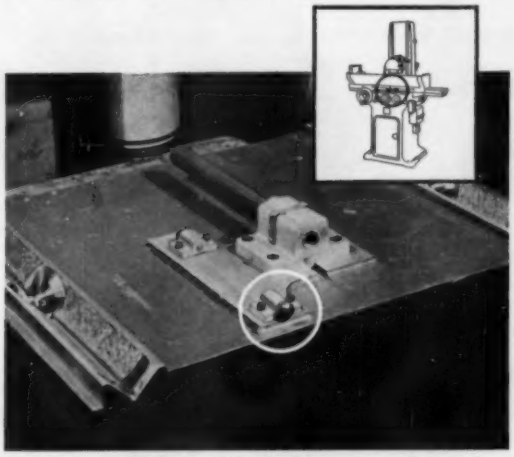
Practical Tooling Tips

Number 2 of a series.

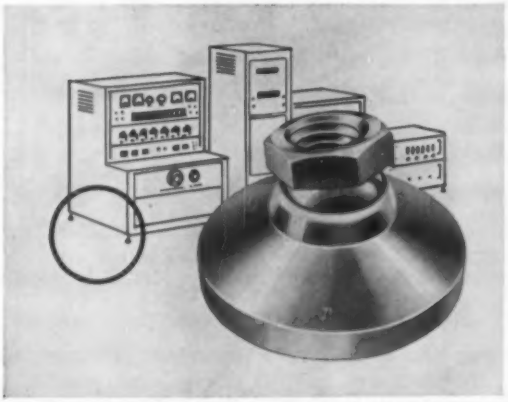
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



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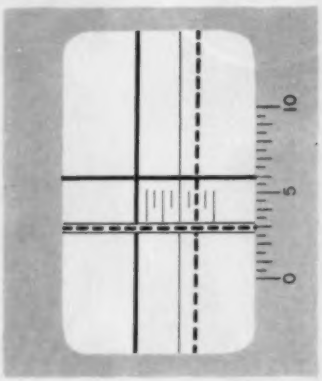

FIG. 8—At Station 1, the autocollimator eyepiece should show the horizontal wire image—dotted line—straddled by the two fine setting lines, in this case at 3 on vertical scale

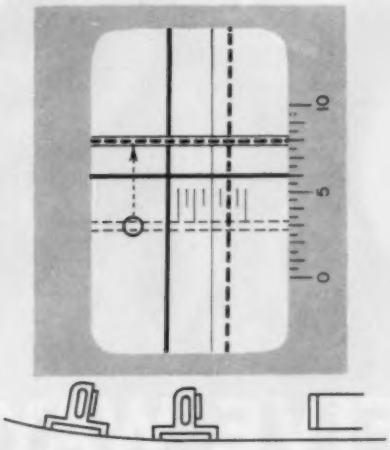

FIG. 9—A "plus" reading at later station. The image of the horizontal crosshair has moved up

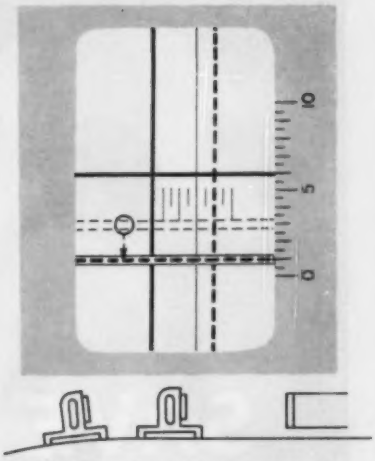

FIG. 10—"Minus" reading on autocollimator

of the reflecting mirror. Set up the corner mirror, the autocollimator and the reflecting mirror as shown. The first reading will be at zero station.

4. Bring the crosshairs in the autocollimator eyepiece to working position, Fig. 8.

The heavy black lines are the fixed wires which are projected by the light source onto the mirrors. Their images are reflected back into the instrument as heavy, gray shadow lines (shown dotted for purposes of identification).

Spaces on the vertical scale in eyepiece each represent a horizontal traverse of 30 sec of arc. Keep the vertical shadow image between a selected pair of these lines, so that you know the mirror carriage is always being moved in a straight line from station to station.

The thin vertical line and the two thin horizontal lines are called setting lines.

With the micrometer set at zero, adjust the foot screws so that the two parallel setting lines straddle the horizontal reflected line.

5. Take micrometer readings at successive stages along diagonal *AE*. These readings are the number of micrometer divisions to restore the setting lines astraddle the horizontal image line and state the angular deviations of the surface plate. The image line moves up or down, giving changes in value of the various stations.

A "plus" reading, Fig. 9, occurs when the rear foot of the reflecting mirror is raised by an elevation in the surface. A "minus" reading, Fig. 10, discloses that the rear foot of the carriage has been lowered by a depression in the surface.

6. Plot the readings along diagonal *AE*, as in Fig. 11, on chart paper, Fig. 12. Here each division is equal to 0.000025 in., or one second of arc. Note: the micrometer scale is read in seconds of arc. Each second is further divided into 0.1 second divisions for accurate readings.

There are two stages for plotting the results. For the first stage, proceed thus:

The first reading is always zero. So put a dot on the 0-0 line at Station 1. The reading at station 2 is –1. So drop down one space and place another dot. At Station 3, the reading is again –1, indicating a point lower by one division than at Station 2. So drop down another division and place a dot. Repeat this process until you reach the last station, in this case, No. 20. Then connect the first and last dots with a dash line, as shown.

For the second stage, you interpret the information in terms of the "profile" of the diagonal, as it varies from the reference line established by the endpoints. To do this, count the spaces between the dots, plus or minus, and the reference line. Record the results, plus or minus, by dots above the 0-0 line, and connect them with a solid

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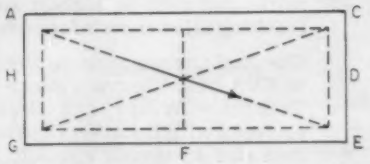


FIG. 11—Problem: to find profile along diagonal *AE*

line. Now you have the profile of the diagonal. In our setup, each second of arc, or micrometer division, is equivalent to 0.000025 in. Therefore, four chart divisions equal 0.0001 in.

7. Repeat this process for diagonal *GC*.

8. Superimpose the two charts at their center points, Fig. 13. Note that the two ends of the profile chart for diagonal *GC* can be marked +0.5 in each case, representing half a ten-thousandth. The center point common to both profiles is +1.5. These are the most important checks of the surface plate.

9. Additional readings for lines *AC, GE, HD, AG, CE* and *BF* can be taken in the same manner. A plot of the profile for one case, *GE*, illustrates the procedure: Instead of converting readings against the zero reference line, a new reference line, Fig. 14, is drawn. Here, *G* is +0.5 and *E* is zero. The profile chart is drawn from this line.

All of the charts will be in like terms; that is, deviations from flatness in seconds of arc. The chart readings can be converted into linear dimensions from sine values. For ease of calibration use 0.000005 per second of arc for every inch of mirror carriage. Thus, for a 5-in. mirror carriage, the value is 5 × 0.000005 = 0.000025 in. for each second of arc.

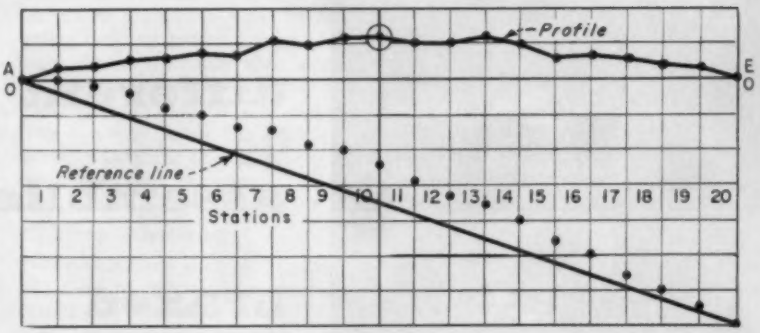


FIG. 12—Lower system of dots represents micrometer readings from autocollimator. Profile chart is plotted from distances between reference line and related dots

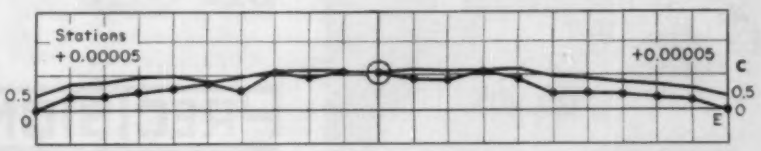


FIG. 13—Profile charts for diagonals *AE* and *GC* are superimposed, so readings along *GC* are in terms of distance to the reference plane *AE*

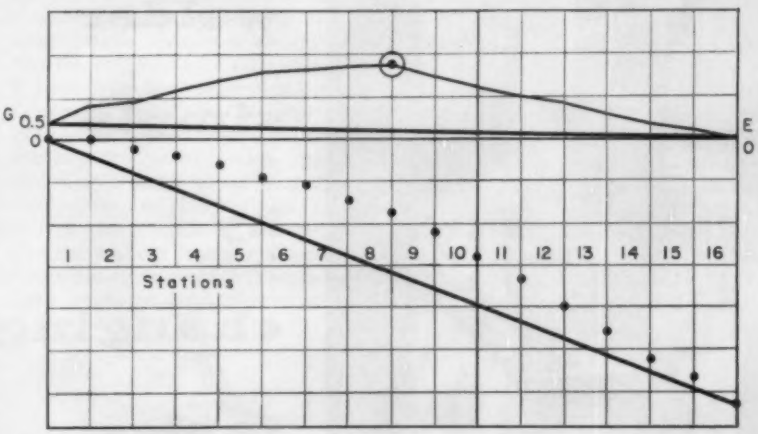
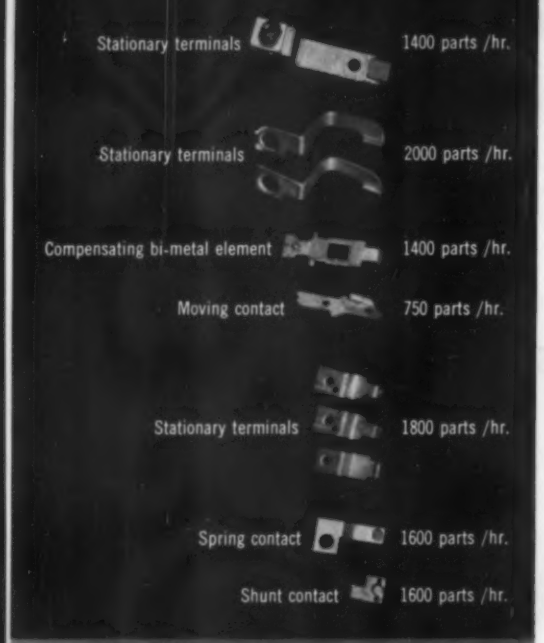
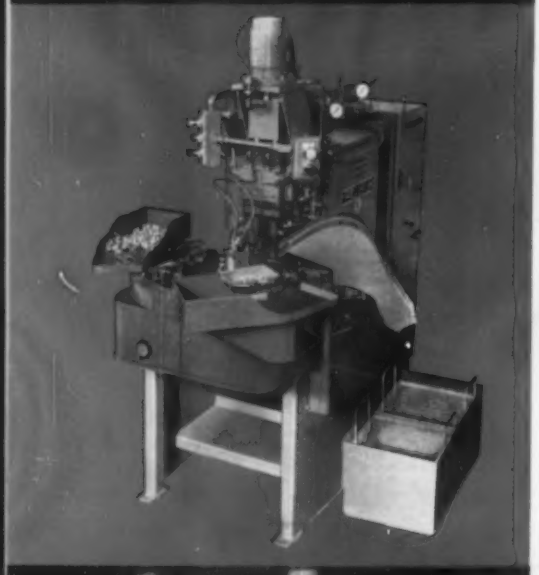


FIG. 14—A new reference line must be established when plotting a profile curve for the centerlines or borderlines of the surface plate





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Talking Shop...

Lucky Production Men

A RATHER STRONG DEMAND was voiced at the recent meeting of the Standards Engineer's Society that magazines provide information in condensed form, classified for easy reference. The idea was a good one, but the speaker was not a production man or he would have known that *American Machinist* has been doing this for several years. Not in every issue, because there we give you the news of production arranged according to its importance and interest. But once a year we take all the individual ideas we have published and present them in a compact, classified form in our Production Planbook Issue. The new issue (Mid-September 1957) should have reached you recently. Once you form the habit of using it as a reference, you'll wonder how you ever got along without this handy tickler file.

Inflation Note

REMEMBER THAT, broadly there are two kinds of inflation, Roger Blough pointed out recently. There is the inflation caused by "too much money chasing too few goods." And there is the inflation caused when wage costs persistently rise faster than output. He says that in the steel industry, wages have increased an average of a little more than 8% a year since 1940. Other costs have increased even faster. Output per man hour has increased only 2 to 3% a year. Prices have gone up an average of 5½% per year. In short, one of the primary causes of inflation is that wages are going up faster than productivity.

Eight in One

INGENUITY FLOURISHES in the small shop sometimes. When Joe Alzebler of Device Manufacturing Co in North Hollywood had a chance to get a large order for some parts, his problem was to drill eight precision holes from four sides. If he had had eight drillpresses he might have tooled the job that way, but he didnt have them. Instead he mounted five Dumore automatic drills on a drillpress post and fixture. Three of the heads were equipped with dual drillheads. The five drills were synchronized and attached to a single control to do the entire drilling job in a single operation. Truly a simple idea and one that has been reported with variations many times. It is a reminder that can't be made too often, however, to look for the chance to combine operations and save.

Hi-Temp Aluminum

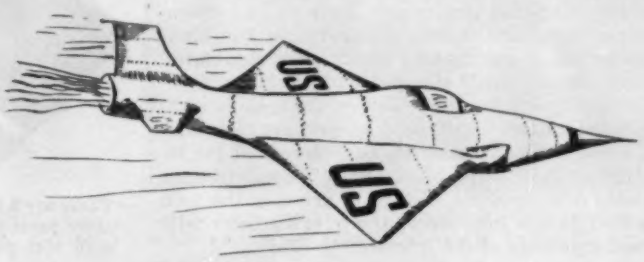
THE POSSIBILITY that aluminum can be used in hypersonic aircraft is raised by the development of ceramic coatings for aluminum made of lithium chromate, lithium borosilicate, and lithium fluoride. Sheets of 2024 and 7075 aluminum, 0.040 in. thick with a coating 0.0015 in. thick showed no damage in a flame test lasting 120 min. at 2200 F, according to Dr Paul A Huppert, who developed the coating at Gulton Industries. These alloys are said to withstand prolonged exposure at about 1300 F without collapsing because of the insulating properties of the coatings. If attempts to develop aluminum alloys for higher than normal temperature resistance are successful, the coatings may raise this 1300 F limit into the range required for hypersonic operation. The new coating can be applied before heat treating and fired at the same time the metal is treated. Once coated, according to Dr Huppert, the alloys can be bent, drilled, punched, or sheared without fracture. Meantime, Alcoa has announced that parts have been produced from powdered aluminum that can withstand 900 F (without any special coating) in comparison with the 500 to 600 F limit for the best conventional alloys.

New Name

PARTS MADE from powder metals will now be called "powder-metallurgy parts" instead of "sinterings" by the 18 companies that make up the Powder Metallurgy Parts Manufacturers Assn. The term "sinterings" was never very accurate and we've generally been referring to them as "powdered-metal parts" and the process as "powder metallurgy." We'll try to adjust our pencils to the slight change involved in the new name. But we'll warn the members of the association that habits are sometimes hard to break. It is surprising, for example, how many people still use the old aluminum designations, several years after the new ones were adopted by all aluminum producers.

Big Vacuum

STEEL INGOTS up to 95-in. diameter and weighing 360,000 lb are now being vacuum cast at the Duquesne Works of U S Steel. A vessel 17 feet in diameter and 30 feet high is placed over the ingot mold and air is removed by four large vacuum pumps. The ladle stream is inspected during pouring by closed-circuit television. Ingots are cast this way that are to be forged into turbine and generator shafts. The gas-free ingot is expected to increase ductility in the forgings and to remove their sensitivity to internal ruptures. Application of the vacuum-cast ingots will probably extend to other forgings that have high-strength requirements. First of these are likely to be airplane parts and large bearings for shipboard applications.



Agents in Principal Cities *Manufacturing Plants in United States and Canada*

Six Societies to Present 170 Papers at

CHICAGO—When the Second World Metallurgical Congress opens here November 2-8, along with the 39th National Metals Exposition, more than 50,000 engineers, management and operating men from 40 nations will fill Chicago hotels to capacity to see some 450 metalworking displays at the International Amphitheater, and to take part in week-long technical discussions.

Six technical societies, headed by the American Society for Metals, sponsor of the Congress and Exposition, will hold concurrent programs at downtown Chicago hotels. In all, 170 technical presentations will be made at meetings of the various societies, with 129 of them scheduled by ASM, 22 by the Metals Division of the American Institute of Mining & Metallurgical Engineers, 10 by the Society for Non-Destructive Testing, six by the Industrial Heating Equipment Association, and three each by the Metal Powder Association and Special Libraries Association.

Most comprehensive program, that of the American Society for Metals, to be held at Chicago's Palmer House and Hotel Sherman, will be made up of 129 papers and discussions—50 in the technical program itself, 42 in Atomic Energy Commission sessions on thorium, welding and metallography; 20 in seminars on metal characteristics. Also scheduled are 17 international panels in which 120 technical experts from the United States, Canada and overseas will take part.

Of paramount interest to metalworking people on ASM's schedule will be a series of international panel discussions to be held at the Hotel Sherman. Among these is the session on steel gears the morning of November 5, which will deal with selection of steel for gears, fabrication of gears, and operations (testing, mounting, stresses).

The metal fabrication group that afternoon will also discuss selection of sheet steel for formability.

Steel Machining Sessions

Machining of steel will be the panel topic the afternoon of November 6, covering problems of machinability, microstructure as related to machinability of common constructural steels, and effect of composition of steel on machinability.

The heat treating group will talk over carburizing the morning of November 4, and later that afternoon will discuss ways and means of minimizing distortion.

Welding and joining people will discuss ship welding Monday morning, November 4; electrodes that afternoon; and stress relieving and preheating on Tuesday morning.

Inspection and testing group will open its first session Thursday afternoon, November 7, with a session on testing in product development, which will cover low-volume production of large components, moderate-volume production of medium-sized components, and high-volume output of medium and small-sized components.

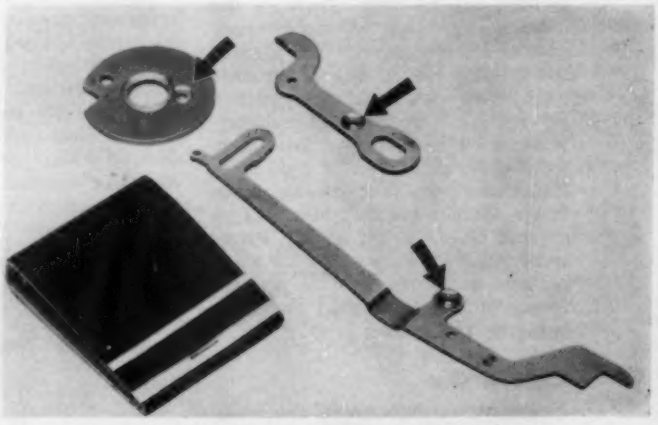
Second session of the international inspection and testing group will cover testing for quality control after product development, including discussions on quality control in the semi-finished product, and quality control in manufacture of components. Session will be held Friday afternoon.

Of interest to metalworking men in ASM's regular technical papers program is a session on zirconium Monday morning in the Red Lacquer Room of the Palmer House. Two papers, particularly, are noteworthy: one on powder metallurgy of zirconium-uranium alloys, and one on hot-hardness of the zirconium-uranium system.

Monday afternoon's steel session, among others, will have papers on distribution of residual stresses in

"While-You-Wait" Spotfacer Grinding

PLYMOUTH, MICH—Spotfacer grinding right in the shop, rather than sending such tooling work outside, has eliminated delays of two to four days in shop production at Burroughs Adding Machine Co. Relief of intersecting blades, such as spotface and chamfer, is being accomplished without undercutting at the point of intersection—or relief of an end-cutting blade without undercutting the adjacent pilot—is being done right in the plant on an R-O (Royal Oak) universal form relieving fixture and grinder. Such multiple operations are ordinarily performed singly as two operations, or with subland tools in one operation. Too, burrs at intersecting or overlapping points were eliminated. Burroughs makes small stamped parts from 0.050 in.-thick cold-rolled strip, and head-recess area is spotfaced. Standard twist drills do the work, but they must be reground without producing an undercut at the intersection of end-cutting blade and pilot. Accordingly, Burroughs developed the method of grinding the tools in the R-O fixture to preserve the pilot diameter with later resharpenings of the intersecting blade.



These are a few of the 0.050-in.-thick stamped business machine parts that are relieved right in the Burroughs plant with R-O ground cutters

Second World Metallurgical Congress

carburized cases, and machinability of Type A leaded steels.

Titanium session Monday afternoon will feature papers on mechanical properties and heat treatment of titanium-niobium alloys, an evaluation of a new titanium-base sheet alloy (Ti-4Al-3Mo-1V), and factors affecting absorption and distribution of hydrogen in Ti during acid pickling.

Tuesday morning session on mechanical properties of steel will include a paper on strain hardening of austenitic steel. Session on brittle fracture will be held later.

Wednesday morning's stainless steel session will open with a paper on effect of microstructure and heat treatment on mechanical properties of AISI 431 stainless, will be followed by papers on effect of aging cycle on properties of Ti-hardened iron base alloy, and carbide precepitation and brittleness in austenitic stainless.

Mechanical properties discussion Thursday morning, November 7, will have three papers of interest to metalworking—effects of temp-time histories on tensile properties of airframe structural Al alloys, mechanical properties of forged chromium, and deformation and fracture of alpha solid solutions of lithium in magnesium. At the same time, a session will be held in the Palmer House Ballroom on thermal cycling of uranium.

Industrial Heating Equipment Association will hold a symposium on "Modern Equipment Speeds Metallurgical Processes" at 9:00 am, Tuesday, November 5, which will have five papers: "Modernization in Heating for Hot Forming," "Metallurgy of Annealing in Fractional Minutes," "Techniques and Metallurgy of Induction Vacuum Melting," "Convection and Radiation in High-Speed Heating," "Influence of High-Speed Strip Annealing on Metallurgical Properties," and "Automation in Heating and Quenching."

Metal Powder Association will present "three papers on pertinent subjects" (sorry, that's all they told us) at 2:00 pm, Thursday, November 7, at the Palmer House.

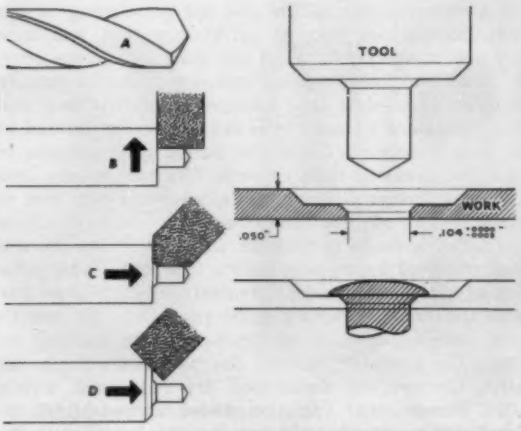
Testing Sessions Slated

Society for Non-Destructive Testing will hold sessions every day from Sunday afternoon, November 3, through Friday, November 8, at the Morrison Hotel, covering: cooperation in non-destructive testing (Sunday); basis for optimum test methods selection (Monday); non-destructive testing of nuclear power reactor components (Tuesday), relative advantages and limitations of non-destructive test methods (Wednesday), educational program for non-destructive testing techniques (Thursday); and recommendations for technical development and standardization (Friday). Mehl Honor Lecture will be held Tuesday afternoon.

Among AIMME Metals Division sessions of interest to metalworking operating men, to be held at the Morrison Hotel, are a Tuesday morning symposium on titanium, a simultaneous session on nonferrous and hi-temp alloys, a Tuesday afternoon discussion of nuclear metals, a Thursday morning symposium on powder metallurgy, and a Thursday afternoon symposium on nuclear metallurgy.

Special Libraries Association's Metals Division will meet Wednesday, November 6, at Armour Research Foundation for a tour and a discussion of "Recent Developments in Nonferrous Metals." On Wednesday, the group will visit International Harvester Co and will talk over new development in ferrous metals. Concluding the Association's program will be an overseas conference Friday, November 8, at the Knickerbocker Hotel on "Library and Documentation Problems Overseas."

Eliminates Production Delays at Burroughs



Drawings A, B, C and D (left) show how standard twist drill is ground. Drawings at right show tool and method of cutting work for recessing of rivet head

Large wheel can be used for making countersinking tools, while an internal attachment can be swung 90° for relief of end-cutting spotfacing blades

NEWS REPORT

Sputnik Scare Won't Up Defense

WASHINGTON — The Soviet's smashing propaganda victory—won by launching "Sputnik," the first earth satellite—one of the great technical/scientific beats of the century —has shaken our top military planners right down to their boots.

But as *American Machinist* went to press, there was no reason to expect that one predictable result will be a sharp upturn in U S military expenditures for weapons.

Missile programs are sure to be affected, but there's doubt that spending for these will be drastically increased; in fact, there's good reason to suspect that the Pentagon's planners will stick to their basic line: we are spending as much on missiles as we can—additional money won't get us any further any faster.

Other suppliers of hard goods—those who make airplanes, and parts thereof—are not likely to see any let up in the big drive to hold down spending.

In fact, any boost in missile spending—if it comes—will serve to rivet even tighter the ceiling that's been placed on spending for conventional hard goods. That ceiling is being riveted tighter week by week.

The Air Force has showed how far it is being forced to go: funds are being withheld from monthly payments to the 42 largest contractors—excluding top-priority ballistic missile projects—over the next nine months. Rumor has it that the amount averages 20% across-the-board. Contractors hit by the withholding are those with unpaid backlogs of at least $5 million; they reportedly account for some 85% of Air Force production expenditures.

Savings Not Yet Apparent

This is what's behind this unparalleled action: the cutback decisions to date have failed to show up as savings fast enough. On the basis of preliminary September spending estimates, first-quarter fiscal 1958 expenditures will run $300 million over the rate required to meet a $19 billion expenditure objective set for the first half of the fiscal year (or half the $38-billion ceiling). In July and August, spending was $400 million too high, according to a daily scoreboard of "checks issued" maintained by the Pentagon comptroller.

A few weeks back, the Air Force was ordered to ask its major contractors for estimates of anticipated monthly billings based on both progress payments and payments due on delivery until next July 1. The total came to at least $1 billion more than the Air Force's anticipated cash on hand over this period. The deficit was pro-rated among the contractors—the proposed withholdings varying from one to another, some observers believe, on how the companies have fared in previous cutbacks. That is, a company like Douglas, say, is likely to have more withheld on future monthly payments than a producer like Republic Aviation, which has been hurt worse under the changes in defense production schedules.

AF Demands Overhead Cuts

In disclosing plans to defer payments, the Air Force asked the contractors to reduce in-process inventories and overhead, and to finance a larger amount of work in process (with interest charges, as usual, not allowable as a cost on cost-reimbursement contracts) before slowing down production. The Pentagon says the decision to defer payments was taken as an alternative to new direct production cuts or orders to put most defense plants on a four-day schedule.

Right now, the Air Force and the contractors are figuring out how the companies can live within the new

One-Step European Method Bores,

NEW YORK—A one-step method of boring, profiling and facing cylinder liners, now in use in Europe, is said to cut machining time in half without sacrificing accuracy. Chamfering and grooving are done in a single operation on a Conomatic KU Pilot lathe (manufactured by Pilot Lathe Div, Cone Automatic Machine Co, New York) thus eliminating need for additional chucking operations that might distort such parts as thin-walled liners. The lathe has a special saddle incorporating a cross slide and boring bar set in the machine's axis, when tooled for turning cylinder liners. Copy-turning cross slide is controlled by a hydraulic servo mechanism and has a front-mounted tool that profiles the OD of the liner. Boring bar, with a special cutter, is surrounded by carbide pads ground to the size of the bore. They serve as supports while the lathe profile turns the OD and the infeed tools plunge the grooves. Machining is simple, for example: a centrifugal-cast iron cylinder liner is cast extra long, with the additional piece tapered to serve as a chucking piece. When part is loaded into the specially jawed chuck, cut is started by pressing a button. As the spindle starts and the coolant flows, templet rotates to control advance of the saddle and the positioning of the tools. Boring tools start to cut at slow feed, and once they are engaged and the carbide pads contact the bore, the front tool faces the end and copyturns the outside chamfer. Then slow feed changes to normal feed and both diameters are cut at the same time. At the end of the pass, saddle stops and the infeed slide plunges to form the grooves, then retracts. Templet rotates and its cam activates the cross-slide, allowing rear tool to partially cut off the liner from the extra chucking piece. Cut is made to 0.020 in. from ID. Extra piece is later removed by tapping with a hammer. Under rotation of templet, cross-slide retracts to clear rear tool from the liner. Completing the operation, the spindle stops, saddle moves on rapid return to the starting position, the operator unloads the part and reloads the lathe. Geometrical distortions are held well within 0.004. Dimensional variation never exceeds 0.002 in. Usual cutting speed is 230 fpm but this varies with the cast iron. Feed rate is between 0.022 and 0.028 ipr at normal feed (slow feed –2.5 to 1 reduction).

NEWS REPORT

Spending

payment ceilings. If contractors say they cannot produce on current schedules with reduced monthly payments, production rates will have to be slowed once more. In special "hardship" cases, the Air Force seems ready to hike monthly payments to contractors.

The verdict—among most Pentagon officials and industry observers—is that a new round of production reductions will result from the latest action.

This is the outlook, as it stands now for military procurement this year: total expenditures will be about 4% less than the $13.5 billion sum in fiscal 1957—or 10% below the rate prevailing during January-June before the wide-scale cutbacks began. For planes, guided missiles, and ships, expenditures will be at the fiscal 1957 level of $10.8 billion—but 8% below the pre-cutback rate.

No Overall Cut Foreseen

Overall, though, there's increasing doubt at the Pentagon that the military will be able to come down to the $38-billion expenditure ceiling. Says one knowing budget official: "if we can get down to $38.8 billion, we'll deserve medals."

Aero SAE's Report on Ceramics, Creep Tooling, Strong Welds

LOS ANGELES — Three important points when machining aircraft materials with ceramic tools are:

- Machine, work, and toolholder must be vibration-free.
- Avoid heavily scaled or out-of-round work.
- Avoid interrupted cuts.

These and other findings in Ryan Aeronautical's continuing research on ceramic tools were reported by J N Willits (*AM*—June 3 '57, p116) at the recent National Aeronautic meeting of SAE here. Results of the second phase of these tests indicate that ceramics can do finishing cuts at higher speeds than carbides with equal tool life.

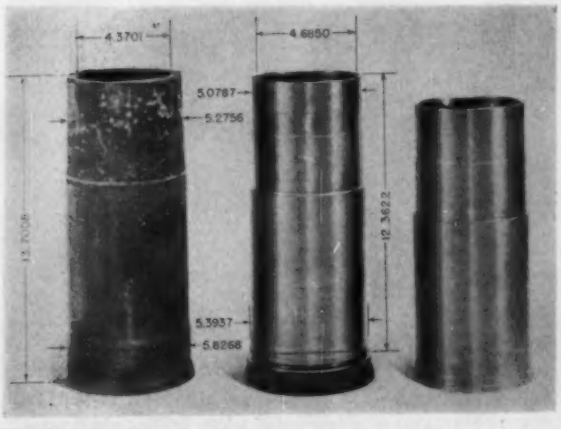
Creep forming is a new technique described by H W Bloom, North American Aviation. Titanium sheet is stretch-formed, shaped in a press brake, and joggled with heated dies in hydraulic presses or mechanical presses arranged for dwell at bottom dead center. Held there at 1000 F or so, the stock relaxes to absorb springback and release strain. Advantages are uniform elongation of the metal, plus the ability to form stock with a press of lower-than-normal capacity. Dies are hot-worked tool steel; heating pads are stainless.

High-strength steel weldments were discussed by B R Alsobrook, Rohr Aircraft Corp, where a number of normally-forged structures have been built in low alloys. At operating temperatures of 500 F, aluminum alloys have no strength/weight advantages over steel, and the main disadvantage of low-alloy steel is rapid oxidation. If suitable storing techniques can be developed for missiles, oxidation would be no problem during operating time. Parts made so far from steel weldments include a fuselage main bulkhead, flap tracks (made partly with standard I-beam sections), and a front engine mount.

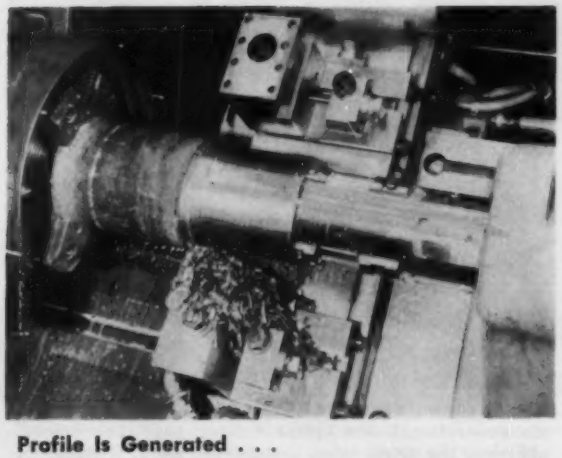
A panel discussion on large structural (aircraft) components considered forging problems and the requirements for machining the forgings. A panel session on high-strength sheet materials operating in the 600-1000 F range covered forming techniques, temperature requirements, and shapes attainable. In conjunction with the meeting an aircraft engineering display with over 100 exhibits was held.

Other subjects under discussion at the meeting included X-ray inspection and applying cadmium by electroplating and by vacuum metallizing techniques.

Profiles and Faces Cylinder Liners



Finished in One-Set-Up . . .
Diesel-engine cylinder liner (French) is profiled on OD and bored. Casting is chucked on tapered end. American firms are considering process



Profile Is Generated . . .
Templet on Pilot lathe's overarm controls cross-slide operation. After boring tools cut pilot diameter, the boring bar is piloted in bore by carbide pads

NEWS REPORT

Cincinnati Milling Reveals

CINCINNATI—Over 1200 production men from all parts of the country have attended a Technical Activities Seminar conducted by the Cincinnati Milling Machine Co. The seminar got under way on Sept. 30, with 400 people present. Participants were split into two groups. One group attended a day-long session on machine tools and controls; the other group considered metalworking processes and products. Full participation in the seminar thus required two days.

Most participants took the "full treatment" because the "Mill" revealed new tools and processes, the results of research on the grinding process and cutting with ceramic tools, and also provided guided tours of the firm's extensive research laboratories.

Improved Drill Geometry—Closed-circuit television dramatically demonstrated the superiority of the "spiral point drill"—the first important change in drill point shape in 100 yr. The conventional twist drill, according to Hans Ernst, director of research, and W A Haggerty, research supervisor, has poor cutting action under the chisel edge and will not center itself unless a suitable center hole or a drill bushing is provided.

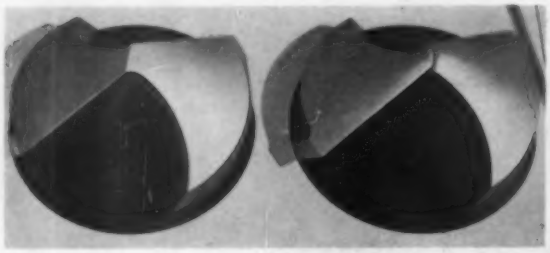
At 0.030 in. from center of a ½-in. conventional drill, the normal rake angle is –53°. At this location the cutting speed is only 7 fpm at 458 rpm, the shear angle is low and thrust is very high.

In the spiral point drill, the flank surfaces associated with each cutting edge are "spiroidal," the drill is formed with a true point and has an "S-shaped" cutting edge. Hence, free cutting action is obtained close to the axis. The spiral-point drill automatically centers itself on the axis of the drill at the instant of engagement with the work.

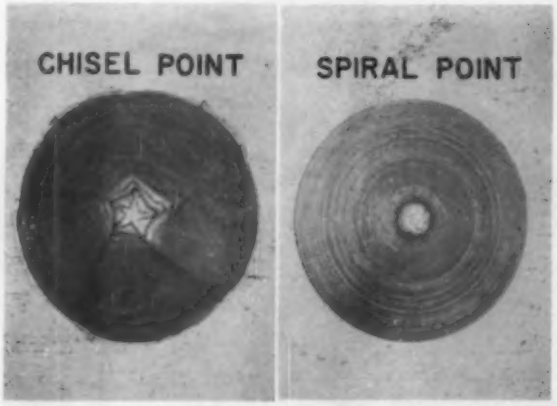
Viewers of the televised demonstration saw two rounds laid loose in V-blocks. A conventional drill walked the piece right out of its V-block, whereas the spiral-point drill centered itself, bit into the metal and drilled the hole. In this demonstration the piece was not clamped; no drill bushing was used.

Because of the self-centering action, the holes produced with the spiral-point drill are usually rounder, straighter, closer to the desired size and smoother than obtainable with the chisel point drill.

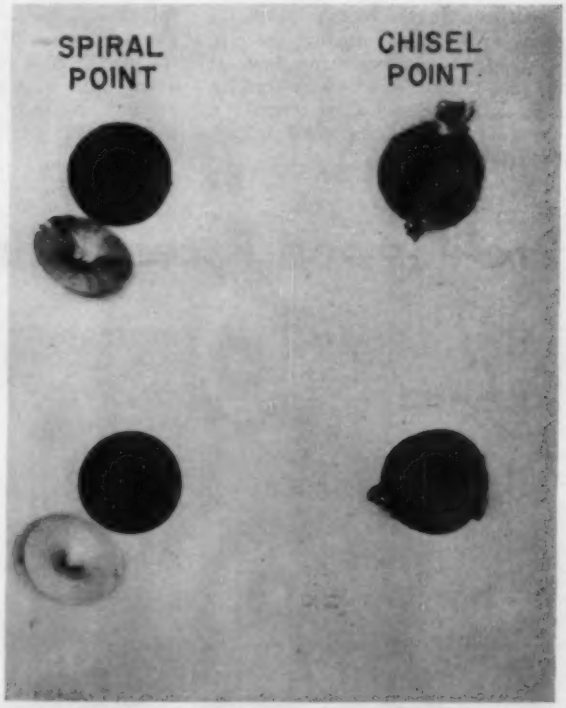
The method of generating this spiral point shape is illustrated by the accompanying simplified diagram. Here, a straight line generatrix (*a*) terminating at the end adjacent to the axis in an arc of small



Chisel point Spiral point



Erratic cutting action and lack of roundness characterize the conventional chisel-point cutting edge. In contrast, wherever the spiral point touches the work, it enters instead of walking to one side or the other. The cutting action is balanced, to produce a hole that is closer to the drill size, may reduce need for rough reaming



By changing the point angle of the spiral-point drill from 118° to 180°, grabbing is avoided when drilling sheet metal. The spiral point entends from the periphery to center the drill. Just before breaking through, a thin layer of material is bulged forward by the point, the cutting edges then trepan, avoiding burr

Tomorrow's Tools and Processes

radius (*b*), is rotated about the axis of the drill while being simultaneously reciprocated through small distances, both radially and axially, twice per revolution. These motions are controlled by a positive camming system. By proper coordination of these three motions in magnitude and phase (with respect to the flutes of the drill) the shape of the end of the drill can be generated, as desired, to provide the following: (1) a true self-centering action; (2) a proper relief for the cutting edge; (3) effective values of normal rake in the region close to the drill axis.

In practice, the generatrix consists of the conical surface of a small grinding wheel whose axis is parallel with the axis of the drill. This grinding wheel gyrates around the drill to form the desired three-dimensional spiral point shape.

Torque values for the spiral point drill are about equal to those for the conventional drill because of the small influence of the chisel edge on this component.

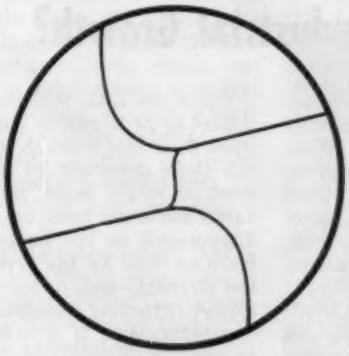
However, there is a significant difference in the thrust values; those of the spiral point ranging from 15 to 34% lower, the improvement being greatest for the lower feeds.

Can Vary Point Angle

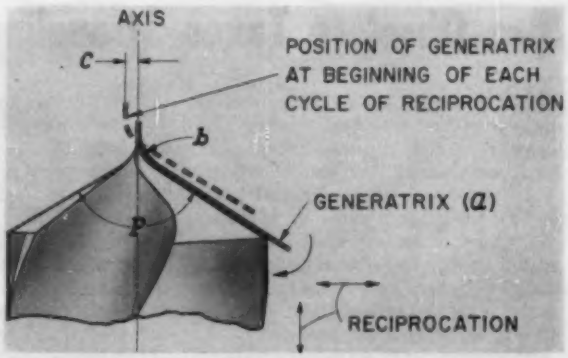
The spiral-point drill is not limited to one particular point angle or clearance. Both of the dimensions may be easily changed to give better performance for a particular material, or for a job which is difficult for drills having spiral points with standard point angle and clearance. One such modification is found to be very advantageous for drilling sheet metal.

In the drilling of sheet metal, the self-centering action of the spiral point drill has been found particularly helpful, because with chisel-point drills it is extremely difficult to obtain a truly round hole, especially with thin, soft metal such as sheet aluminum. This is true of both power and hand drills. However, a further problem in drilling sheet metal, both with chisel-point drills and with the spiral-point drill as described thus far, is the "grabbing" of the drill as it breaks through the hole. This usually results in leaving a large burr on the spiral point.

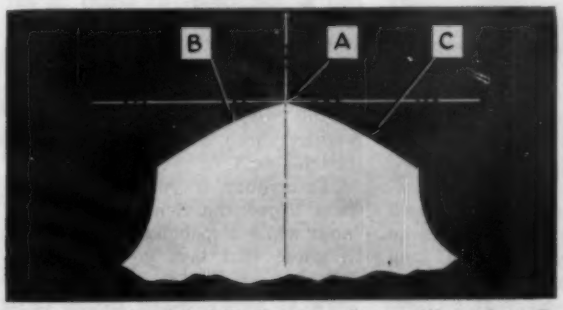
This modification consists of merely changing the point angle of the drill from 118° to 180°. However, the central portion of the drill point retains its characteristic spiral point extended ahead of the periphery and, therefore, contacts the work surface first, thus centering the drill. Just before breaking through the bottom of the hole (in sheet metal) a thin



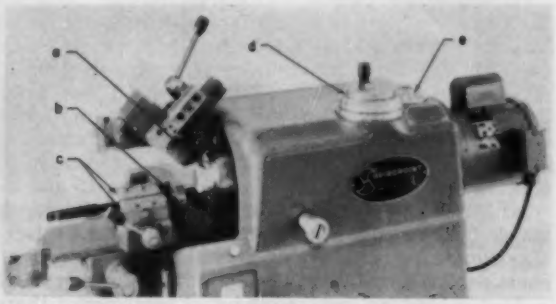
An "S-shape" cutting edge is the feature of the spiral point, improving the rake angle



Generatrix (*a*) is the conical surface of a small grinding wheel whose axis is parallel to the drill axis



In the spiral point drill, the secondary cutting edges *B* and *C* are intersecting arcs that leave a sharp point *A* coinciding with the drill axis. These cutting edges produce a free cutting action, instead of an extruding action, as occurs with high negative rake of chisel point



Drill is stationary in "Spiropoint" grinder, which can be hand loaded or provided with an automatic feed. The wheel is rotated about the drill axis and simultaneously reciprocated radially and axially through small distances, twice per revolution

NEWS REPORT

layer of the surface material is bulged forward by the spiral point; the peripheral portions of the cutting edges then act as trepanning tools to eliminate the burr.

Spiropoint Drill Grinder—In order to make the spiral point of practical use, a machine is required which will grind this geometry accurately and economically. The "Spiropoint" drill sharpener is so designed that the drill is held stationary, while the generating system gyrates around it.

The small tubular grinding wheel (*a*) is mounted in a rotatable carrier so arranged that the desired shape is generated on the end of the drill as the grinding wheel gyrates around the drill axis. An adjustable truing device is provided for the grinding wheel so that the point angle of the drill may readily be varied from about 90° to 180°.

In operation, the drill is oriented against a retractable control bushing (*b*) and clamped in the jaws (*c*). It is then advanced so as to engage the continuously gyrating grinding wheel until the desired amount of stock has been removed. The entire sharpening is very rapid. A simple dial-indicated adjustment (*d*) provides the correct combination of radial and axial motions for any desired size of drill. Adjustment for values of relief above or below the standard amount (to meet special requirements) may be provided by rotating the second adjustable dial (*e*).

Other Fruits of Research—Additional Seminar papers and laboratory tours pointed up Mr. Ernst's remarks about the fruits of the Mill's 25-yr interest in basic and applied research, now being carried out by 12 groups. One example is the "Digi-Log" numerical control, which is both an accurate analog system and an absolute system, which uses toroidal transformers for an exceptional degree of accuracy, either in positioning or contouring.

Ceramic tools have been found to wear differently than carbide tools. Chipping along the cutting edge has been reduced by proper application and use of chipbreakers. Certain ceramics may outperform both cemented carbides and cermets on steels, cast iron, and many non-ferrous materials. Cuts were being taken at 2000 fpm on a large test log of nickel-alloy steel, producing a very high finish. Super alloy of 400 Brinell was heated by an induction coil and milled with a flycutter at 450 fpm, 0.006 ipm feed, and ⅛ in. depth of cut. AISI 4340 can be milled at 2000 fpm. Cincinnati engineers said that modern designs of machine tools will have adequate strength, power and speed for ceramic tooling. Despite expectation of further improvements in ceramic tools, research on the metal-bonded cermets will continue.

In the field of grinding research, Cincinnati has developed and is applying a cylindrical grinding dynamometer. This device is making it possible to find the grinding ratio (volume of metal removed per unit of wheel wear) for various materials and grinding conditions. In other words, Cincinnati's work is intended to change the grinding process from an "art" to a science. Additional grinding research is directed toward the discovery of new and better abrasives.

Are Obsolete Taxes Strangling US Industrial Growth?

SAN FRANCISCO—Every industrial nation in the free world offers incentive to risk capital—except one. That exception? The United States. The consequences? Modernization of capital facilities is going on at a terrific pace in those countries, while in the United States today more than half of the machine tools in use are more than 10 years old and can definitely be classed as obsolete.

That statement was made here at a hearing of the Senate Select Committee on Small Business by J O Ellison, president of Harron, Rickard & McCone Co of Northern California, San Francisco machine tool distributor. Mr Ellison, who is first vice president of the American Machine Tool Distributors' Association, was expressing his views as a private businessman on U S tax depreciation policies.

Mr Ellison suggested four ways in which the government can effect a tax climate more favorable to expansion of U S industry:

- Abolish and do not re-issue the 1942 edition of Bulletin F.
- Establish a simplified maximum rate bracket for depreciation of capital equipment in a 5-10 year period at the taxpayer's discretion.
- Issue a new bulletin setting forth a full explanation of the new policy and approved practices, so that an "orderly and effective transition" from past policy to the new policy will result to the benefit of the taxpayer and to the Bureau of Internal Revenue.
- Discontinue the capital gains treatment of disposition of machines and other assets that have been subject to the new depreciation policy, and instead treat such profit as ordinary income. This would eliminate unintended tax benefits.

The government's present arbitrary long-term depreciation policy, Mr Ellison said, is based upon the supposition that a given machine tool has a life expectancy from showroom to scrap pile of something between 15 and 25 years. But government policy does not take into account the fact that such a machine is of value to its owner only as long as he can market the product or services of that machine at a profit. "Frankly, I do not know of a small business anywhere which can be assured of continuity over such a period of time."

Today, the little businessman finds it hard to get credit to buy new machine tools and must in many cases buy those discarded by the government or larger firms. But unfortunately the larger firms, too, have been discouraged in the buying of new machine tools by tax laws over the last 30 years—and the result is widespread "creeping obsolescence" and degeneration of U S industrial capacity.

"The mere shifting of a used machine," Mr Ellison added, "does not add to the industrial might of our nation. Change the law if you will, and I certainly feel you must, but please do not lose sight of the need for incentive in our economy—nor of the very necessary element of healthy small businesses in the industrial field.

"Remember, if you will," Mr Ellison urged the Senate Committee, "that while a machine tool is a sort of goose that lays golden eggs in times of peace and war, we cannot grow as an industrial nation using the same old goose for 20 years—when all around us there are new geese being hatched on a much more frequent cycle."

British Laborites Will Move in on Machine Tool Industry—If They Get In

LONDON—First steps toward nationalization of the British machine tool industry will be taken by the Labor Party should it be voted into office at the next British national election. The proposal is that a controlling amount of shares be bought by the government in one or more machine tool companies and that the nationalized company's policies be used as a prod to the remainder of the industry to do some of the things that the Labor Party leadership would like to see done. The program would be financed by using the government's social insurance funds.

The Labor Party's strategists have tied the need for nationalization to problems of automation. One of the factors most seriously limiting the progress of automation in Great Britain up to now has been the slowness of the machine tool industry to adjust itself to the new demands, the report of the Labor Party's national executive committee states. "In this industry, and in some others, we shall need to consider some measures of public ownership." The report then cites the publicly-owned Renault (French) company as having achieved, without unemployment, far more automation than any British car firm.

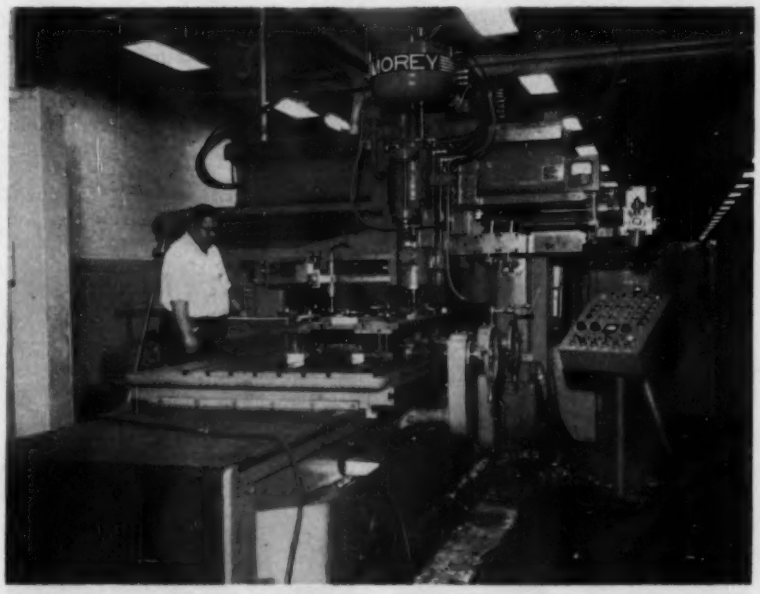
Even on the assumption that a maximum amount of enterprise is spontaneously forthcoming, the report says, government initiative will still be essential in stimulating research, in encouraging and coordinating enterprise, both public and private, and in anticipating and providing for social adjustments.

It is important that automation be put into proper perspective, the report states. Contrary to the idea that "we are on the threshhold of a push-button age," there are many industries and millions of jobs that cannot be automated in the foreseeable future. On the other hand, the assertion is not true that automation offers nothing new. Though the first automated plants were set up a long time ago, some of today's developments are different in kind. Increased productivity from them is much greater and will displace labor that cannot be absorbed elsewhere.

Automation is interlocked with many aspects of government policy-making, the report asserts. Greater mobility of labor will be needed, housing thus being affected. Dislocation of labor and perhaps earlier retirement will result and the nation's social insurance policy will have to be altered. Beyond that, many problems impinging upon the concern of trade unions will arise—projected redundancy (displacement of labor); elimination of piecework and bonuses; possibility of a guaranteed wage over a fairly long period; changes in promotion policy; increase in shift-working; and changes in industrial accident hazards.

"It is important to realize," the report emphasizes, "that the advantages of automation need not be confined to those industries and processes where full automation of the whole business is possible. There probably are few firms in which there is no scope at all for its application. The rate of progress in the immediate future, therefore, will be largely the product of imaginative enterprise by management coupled with understanding and adaptability by workers and trade unions."

The report was in response to a resolution adopted at the 1956 Annual Conference of the Labor Party to publish within six months an effective statement providing for "the Socialist planning and control of automation to ensure that the whole community benefits from the new technological age; prior consultation with the trade unions before automation is introduced; adequate compensation in the event of redundancy; and an educational program to provide adequate technical workers to man the automated plants."



Profiler for the Martin SeaMaster

Just put into operation at The Martin Co's Baltimore Division is this Morey "Extra Heavy Duty Aeroframe Vertical Profiler and Milling Machine," which automatically profiles or mills aluminum or steel details of the multi-jet Martin SeaMaster seaplane. One of the largest in the East, this machine is equipped with an electro-hydraulic 3-dimensional tracer that simultaneously controls longitudinal, transverse and vertical movements of the head. Table is 48 in. wide by 120 in. long, with 24-in. travel. Throat depth is 66 in., and transverse movement of cutter head is 60 in. Vertical travel of spindle is 12 in. Machine has 16 spindle speeds, from 20 to 3600 rpm

New Look in US Tool Leasing Policy

WASHINGTON—Uniform rules for leasing government-owned machine tools and other production equipment have been set up by the Office of Defense Mobilization. The new rules come on the heels of a recent decision to establish uniform rental rates.

The new rules apply to the government's multi-billion dollar inventory of production equipment—$2.9 billion worth in the hands of the military services. Some 145,000 of the machines are installed in private plants. Up to now, the government agencies owning the equipment have allowed tool rentals under a wide range of contracts with different types of provisions on terms, purchase options, installation charges, maintenance, and the like.

Same Policy for Everyone

Says an ODM official: "The new regulations set up uniform leasing practices so that all lessees get the same treatment. There will be no competitive advantage for one company over another because of variations in the leasing arrangements."

For the first time, the new policy requires all tool rental contracts to provide in writing (1) the periodic dollar amount of rent to be paid by the lessee, and (2) whether this sum is to be credited against government payments to the contractor for end-items produced for the government's account. In the past, this matter has been fuzzy, with offsets for tool rentals usually liberally employed in negotiating for end-item prices.

In general, this is what the new rules provide:

- **Length of lease.** Rental contracts will now be written specifically to "cover the span of time needed to carry out (defense production requirements), with latitude for adjustments to meet changed circumstances." Up to now, rental terms have been inconsistent, running most frequently from three to five years, with little regard to actual military production requirements. Invariably, there has been widespread use of government-owned tools for non-defense production; the defense production contract may have been completed, but the rental agreement was still in force.
- **Renewal and purchase options.** Purchase option provisions will be included "only in exceptional cases or where prescribed by law." Renewal provisions will be excluded from tool leases. In the past, some rental agreements allowed for renewal or purchase options, others didn't.
- **Maintenance and installation.** Contracts will provide that lessees bear installation charges and that equipment be returned to the government in the condition received, ordinary wear and tear excepted."
- **Transportation costs.** Lessees will bear transportation in and out and removal costs "in a manner best suited to the particular circumstances" of the transaction.
- **Rebuilding and overhauling.** When equipment is rebuilt or modernized at government expense, the tool's acquisition cost—upon which rental fees are based—should be boosted to reflect increased value of the leased equipment.

The new rules follow pretty much the recommendations made recently to ODM Director Gordon Gray by an inter-agency government committee of machine tool administrative officials. But Gray stresses that one Committee recommendation has been sidestepped and can be carried out only through legislation: a proposal to set up within each agency a fund to finance equipment and modernization costs out of rentals paid to the government on tool leasing. A bill to implement this recommendation has been introduced by Senators Sparkman (D, Ala) and Thye (R, Minn).

Though establishing uniform leasing practices, the new rules allow for exceptions to be made by ODM. The new rules also emphasize that government-owned production equipment is not to be leased to private industry until "its unavailability from private sources has been established." The new rules do not apply to wholly-owned government facilities operated by private contractors on a cost-plus-fee basis.

In releasing the new rules, ODM publicly defined for the first time what constitutes "defense leasing"—at least 75% of the use of the equipment must be on military prime or subcontracts.

Westinghouse Talks Materials Handling

COLUMBUS—The present revolution in manufacturing methods and the increasing need for developing better ways to handle tomorrow's materials and products, were key topics at the Sixth Biennial Materials Handling Conference, sponsored by Westinghouse Electric Corp at its plant here October 1-2.

Most speakers and discussion groups stressed the need for simple, strong, and reliable components that will withstand the heavy, continuous demands of automated equipment. As J G Shepherd of Chrysler's Newark, Del assembly plant put it, "What the automobile assembly industry needs is conveyor and conveyor control equipment which has the ruggedness of Gibraltar and the precision of a watch."

Operating difficulties with highly complex machinery can be reduced sharply with standardized, simplified control components, several participants reported. "It is likely that in the future the industrial control field will see static components replace virtually all controls with moving parts," reported Westinghouse engineer Howard A Zollinger.

Other talks on handling problems: stacking cranes for vertical storing, by J W Robinson of Chicago Tramrail Corp; limitations on performance of modern bucket hoists, by R E Stephan of Dravo Corp; operation of an automated lumber mill, by B G Schneider of Chain Belt Co; and synchronized conveyors in an automotive assembly plant, by G E Mathias of Westinghouse.

A highlight of the two-day seminar was the address to the group by C H Weaver, Westinghouse Vice President for Atomic Power on the subject "The Shape of Tomorrow's Atomic World."

Frank J Fields, formerly executive vice president and general manager of the Sidney Machine Tool Co, Sidney, Ohio, has been named works manager of the Fosdick Machine Tool Co, Cincinnati. Mr Fields was at one time with the Falk Corp, Oil-Gear Co, and with Kearney & Trecker

Wendell F Carney, New York sales manager for Taft-Peirce Mfg Co, Woonsocket, R I, has been named general sales manager, succeeding **Walter E Rogers,** who has requested inactive status because of his health. Mr Carney joined the company in 1941 as a design engineer

Richard E Krengel, manager of interplant production for Ex-Cell-O Corp, Detroit, has been named general manager of Ex-Cell-O Corp of Canada Ltd, with headquarters in London, Ont. During his 28 years with the company, Mr Krengel has coordinated work of Ex-Cell-O's Canadian and U S plants

NAMES IN THE NEWS...

Robert Paxton has been named to the new office of vice president—operations for General Electric Co. Other new GE appointments: **Arthur F Vinson** to succeed Mr Paxton as VP and group executive Apparatus Group; **Halbert B Miller** to vice president—Manufacturing Services; **James H Goss** to VP and group exexutive—Consumer Group.

W H Jorgensen has been appointed general manager of Cleerman Machine Tool Corp, Green Bay, Wis. He was formerly chief engineer. **W Gerald Tyson** has been named chief engineer for all engineering, development and research.

Chrysler Corp's Stamping Division announces six new appointments: **Roy Blasiola** to manager, Mack Ace Stamping Plant; **Walter B Connolly** to manager, Outer Drive Stamping Plant; **T W Denomme** to factory manager, Russell-Ferry and Meldrum Plants; **Joseph D Quinn** to Division manufacturing engineer; **John W Slump** to plant manager, Division interior trim unit; and **Herbert J. Winegarden** to division manager of quality control.

John Montean has been appointed manager of the Cri-Dan Division of the Lees-Bradner Co, Cleveland. He recently has been assistant manager of the division and before that was the division's chief tool designer. **(NOTE: In *American Machinist*, issue of Sept 23, '57, it was stated in error that J A Bradner had been appointed manager of the Cri-Dan Division. Mr Bradner is president of Lees-Bradner Co and has long served ably in that position—THE EDITORS.)**

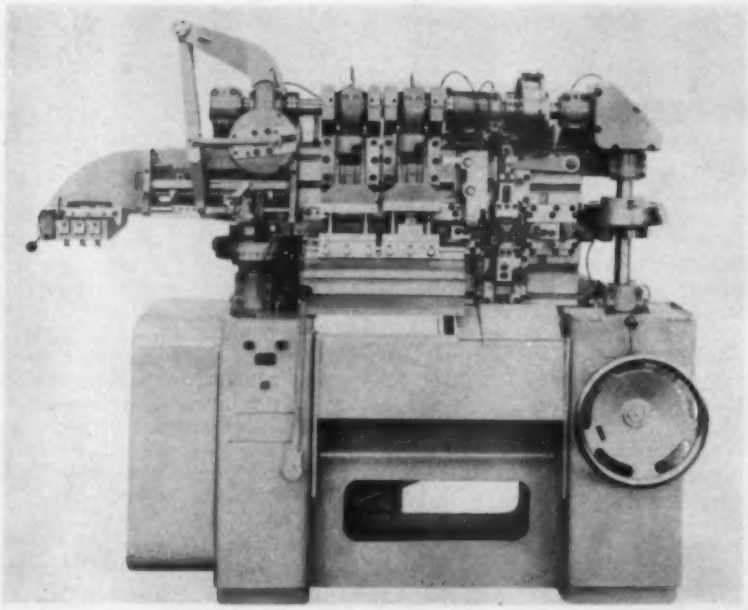
George E Merryweather, vice president and secretary of Motch & Merryweather Machinery Co, Cleveland, was named secretary-treasurer of the American Machine Tool Distributors' Association at that organization's recent annual meeting in Cleveland

Harold J Siekmann, vice president and chief engineer of R K LeBlond Machine Tool Co, has retired after 47 years with the company. Mr Siekmann joined the machine tool firm in 1910 as an apprentice draftsman, was named VP and chief engineer in 1944, a director in 1954

Harry C Kemper has been appointed chief engineer of R K LeBlond Machine Tool Co, Cincinnati. Mr Kemper, who started with LeBlond in 1923 as a detail draftsman, worked with company founder R K LeBlond on development of the Regal milling machine and the thrust lock tailstock

Metal Show | in print

Many of the new products to be introduced at the Metal Show are described here. All will be on display, along with many others previously described in* American Machinist, *at International Amphitheatre, Chicago, November 4 to 8



Vertical Four-Slide Machine Cuts Setup Time and Tooling Costs

The Verti-Slide, the result of more than four years of development, is reported to be the only all-purpose vertical 4-slide machine made in the U.S. Two outstanding operating advantages are superior visibility and accessibility to all parts of machine, particularly the tooling area, and reduced floor space. Setup time and tooling costs will be substantially reduced since most operations can be performed by setup man while standing in front of machine. Adjustment of feed stroke, cams, presses and cutoff are made at same position in front of the machine.

The center form is mounted in the bed, providing both a stronger and more rigid mounting and a better view of the tooling area. Slides and slide bases are separate assemblies which can be removed from the bed, permitting use of special attachments or slides. Cams are split type and are adjustable through 360°. Insert-type cams will also be available.

Machine requires no opening in the bed for disposal of parts because parts are ejected from front of machine.

Torrington Mfg Co, Torrington, Conn

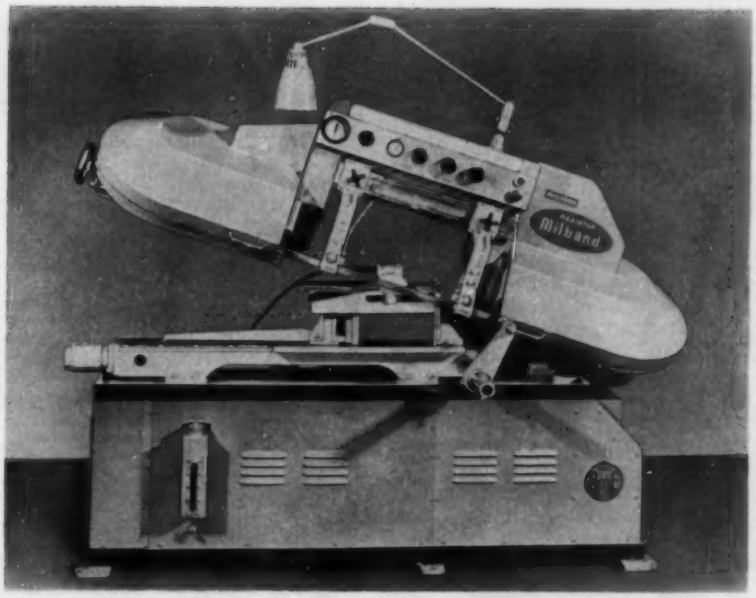
Electrolytic Oscillating Grinder Grinds Carbide Tools

Model SCE-6 grinding machine, shown here equipped with Anocut unit for electrolytic grinding, has an oscillating spindle. Both oscillating frequency and length of stroke are variable; frequency, from 0 to 160 per min; stroke, from 0 to 1½ in.

Table is mounted on ball-bearing ways and is moved toward wheel with light manual pressure. Pre-determined grinding depth can be set on a micrometer dial, calibrated to 0.001 in. Angular setting ranges from 10° above to 25° below horizontal, with no movement of the table toward the wheel. Table equipment consists of a compound protractor for manual tool holding; and for clamped tool holding, a compound protractor vise and a tool positioning gage. Fog is removed by a built-in MistKolector which returns captured coolant to pump and tank unit in base where it is filtered.

Also to be shown is a new abrasive belt finisher for flat work.

Hammond Machinery Builders, Inc, 1600 Douglas Ave, Kalamazoo, Mich



Fast Blade Speeds and Heavy Feeds Featured in Bandsaw Machine

New heavy-duty bandsaw machine, designated the Milford Rezistor Milband machine, was produced by American Machine & Foundry Co and jointly developed by AMF and Thompson engineers. It was designed and built specifically to utilize the full cutting capacity of HSS band saw blades. Used with Thompson's Milford Rezistor blades, machine is expected to establish new standards of speed, efficiency, accuracy and economy.

Blade speeds are adjustable from 40 to 360 fpm. All controls are on a single panel at front of machine. Located immediately above the control panel is a "Job Selector" chart that guides operator in selecting correct tooth-per-in. and blade speed for various jobs. Hydraulic blade feed automatically compensates for increased resistance the blade meets as it cuts into heavier cross-sections.

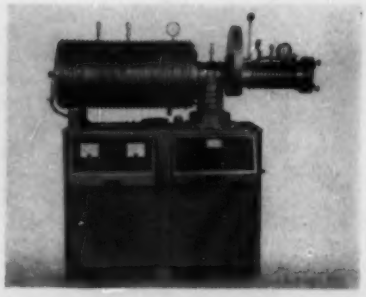
To minimize blade-flexing stresses, machine is equipped with oversized 22-in.-dia blade wheels. Blade twist between the wheels and the guides is also held to a minimum. Efficient blade cleaning is provided by high-pressure coolant stream as blade leaves cut. The reservoir for the recirculating coolant system is in base of machine.

The hydraulically operated stock vise has a standard capacity of 10 x 10 in. and permits adjustment for cutting angles up to 45°. Unique design provides an unusually compact, efficient nesting attachment for gang-cutting.

An automatic indexing bar feed is available as an optional accessory. This mechanism makes operation of the machine fully automatic. Unit, equipped with a 1-in. x 15-ft blade and powered by a 3-hp drip-proof motor, is 31 in. wide, 50 in. high (with head down), and 82 in. long.

Henry G Thompson & Son Co, New Haven 5 Conn

TUBE FURNACES (illustrated) and box furnaces feature lighter, less-expensive transformers, in addition to entirely new type resistance elements—*Laboratory Equipment Corp, St Joseph, Mich*

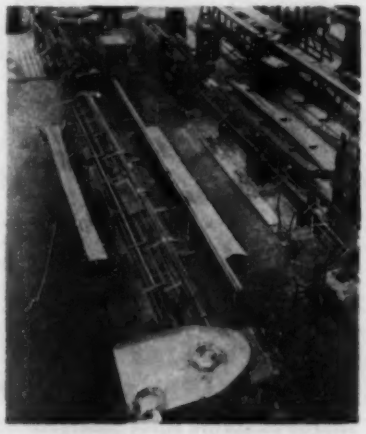


Vacuum Annealing Furnace Easily Converts to Melting Furnace

Model F1212-2A vacuum annealing furnace is of the double-pumped muffle type and has a hot zone of 6 in. OD by 12 in. long. It is capable of operating continuously at 2150 F or intermittently at 2200 F at a pressure of 1 x 10^{-4}mm Hg or less. Vacuum retort and cooling chamber are completely insulated and water cooled.

Using the same cabinet, power supply, and pumping system, the unit is converted to a melting furnace simply by removing the horizontal assembly and substituting a spherical melting chamber with a resistance-heated furnace and a crucible suitable for melting 12 lb of steel at temperatures up to 2000 F.

High Vacuum Equipment Corp, 2 Churchill Rd, Hingham, Mass



TUBE PROCESSING LINE is made up of uncoiler, drawbench, roll straightener, flying cutoff, automatic discharge conveyor, and a recoiler. This line at Chase Brass & Copper Co, Cleveland, Ohio, handles ¼ to ¾-in.-OD copper tubing at an output rate of 200 fpm—*Loma Machine Mfg Co, Inc, 114 E 32 St, New York 16, NY*

Metal Show | in print

Branson Introduces Self-Contained Ultrasonic Cleaning Unit

Model R-50 self-contained ultrasonic cleaning unit includes a heater, temperature control, filtration and recirculation system in addition to the generating equipment. Over-all dimensions are 22 x 19 x 37 in. high. Piping, pump, and filter are made of stainless steel, with Teflon gaskets, making the unit suitable for alkaline solutions, solvents and mild acids.

The 6 x 16 x 11-in.-deep tank has a total working volume of 5 gallons. Transducers, mounted to bottom, have a rated input of 250 r-f watt average (1 kw peak) which they convert to 38-kc mechanical vibrations.

Branson Ultrasonic Corp, 40 Brown House Rd, Stamford, Conn

New Direct-Reading Spectrograph Speeds Accurate Alloy Analysis

New French-made direct-reading spectrograph permits measurement of instantaneous values. It uses two photomultipliers—one views the line of the basic metal; the other stops at selected lines for a pre-determined length of time. A device called an Analyze Ruler determines the stops of this second multiplier. Steel studs are located on this ruler to correspond to the position (± 1 micron) of the lines on the spectrum. A series of special rulers, termed Program Rulers, permit the operator to program the unit so the multiplier stops only at required lines.

To avoid expensive temperature control in the laboratory, the instrument is equipped with a temperature compensator that can be set at any point between 16 and 32 C.

On the right in the illustration is the electrostatic-screening cabinet; in the middle, the Jobin & Yvon quartz spectrograph; at left end of spectrograph, the direct-reading head in front of the automatic control cabinet. On the left, the amplifier and recorder cabinet.

Average time for a complete alloy analysis is about 1½ minutes. The reproducible accuracy is extremely high. Based on many analyses, it has been established that the standard deviation of the method is as low as ± 1%. Cost is approx $30,000-35,000, considerably less than American-made instruments of this type.

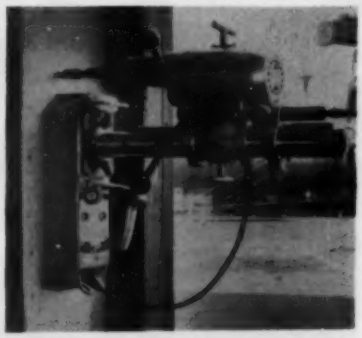
Intercontinental Electronics Corp, 1551 Franklin Ave, Mineola, NY

Machine Straightens and Cuts Wire up to ¼ in. Diameter

The new 2CV4, one of a series of "convertible" wire straightening and cutting machines, features a dual-center straightener arbor which increases the range of the machine and makes it possible to straighten small diameters below the capacity of other machines. This machine has a capacity of 1/16 to ¼-in.-dia wire. Higher production is achieved through use of a variable speed drive which permits the correct feed speed (up to 200 fpm) for all requirements. Unit is easily adapted to handling shapes, hex, or flats by installing an interchangeable roll straightener.

The Model 4FH machine, a high-speed wire straightening and cutting machine will also be on display. It features traveling cutoff which, in conjunction with an air clutch and variable speed drive, permits perfect synchronization with the wire at all feed speeds. This FH Series will be available in sizes to handle wire from 1/16 to 1 in.-diameter.

Lewis Machine Co, 3441 East 76 St, Cleveland 27, Ohio



Magnetic Drillpress Has Remote-Control Hydraulic Power Feed

Designed for continuous duty, this 1¼in.-capacity drillpress operates on ac or dc current without danger of overheating and consequent loss of magnetic holding power. Among the other features of the unit are a drill point locator for immediate, exact positioning; two-piece construction for ease of handling; and remote-control hydraulic power feed which enables operator to stand clear of work.

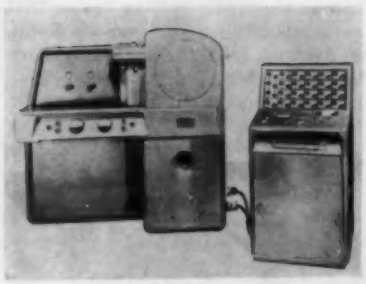
Unit is built to drill holes within 1/64-in. accuracy. Direct magnetic pull is 3500 lb. Length of drill stroke is 15 in. The detachable magnetic base can also be used as a powerful holding device for such jobs as welding steel plates.

Black & Decker Mfg Co, Towson 4, Md

Oakite Introduces New Cleaning And Finishing Materials

New materials for phosphating, barrel finishing, rust and scale removal, and paint stripping include a non-foaming alkaline detergent designed to remove identification inks from aluminum; a barrel burnishing compound said to produce superior color and luster; a powdered acid scale and rust remover; a solvent acid stripper that removes tough epoxy resins at room temperature; and a new zinc phosphating compound for low temperature applications.

Oakite Products, Inc, 19 Rector St, New York 6, NY



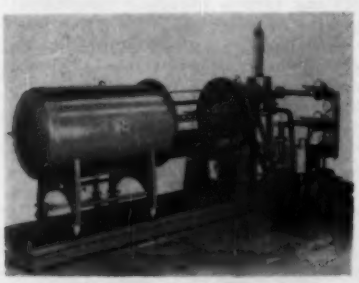
X-ray Spectrograph Features Extended Analysis Range

Recent design additions to the Norelco Autrometer, multi-indexing spectrograph, have extended the range to include 81 elements, from magnesium to uranium.

The new Autrometer provides an accurate and rapid analysis of products in any critical stage of manufacture and indicates need for addition or removal of elements to guarantee uniformity of mixes, batches or degree of purity of components. Developed to save time and effort for the chemist, the instrument is a tool for maintaining precise quality control of incoming raw materials, processes, and finished products.

Main chassis assembly is a desk-type structure that houses the X-ray tube and generator tank, goniometer mechanism, crystal and counter, and specimen changer.

Philips Electronics, Inc, Instruments Div, 750 S Fulton Ave, Mt Vernon, NY

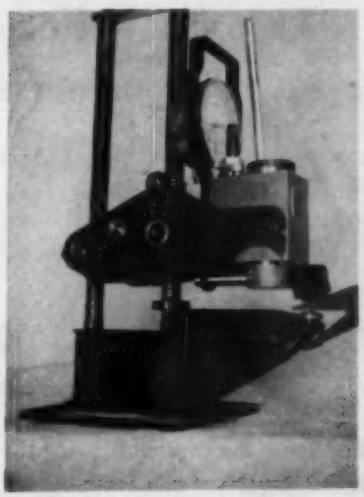


Medium-Sized Vacuum Metallizer Processes 3 to 5 Batches per hr

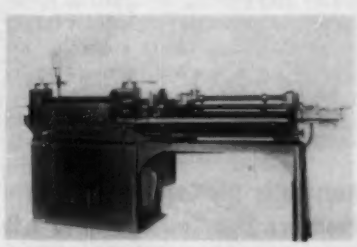
Model 3143 Industrial Vacuum Coating Unit is recommended where volume of work is insufficient to utilize capacity of large production coater. Production which starts small in the Model 3143 can be expanded easily since the jig rods and workholding fixtures are interchangeable with those of company's larger machines.

Unit comprises a 5-ft long 42-in.-dia horizontal coating chamber which provides 12,000 sq in. of coating capacity per load. Pumping system will exhaust an empty chamber to coating vacuum in less than 10 minutes. When fully loaded, the unit will process three to 5 batches per hr. Machine is furnished complete, ready to commence operation.

NRC Equipment Corp, Subsidiary of National Research Corp, 160 Charlemont St, Newtown Highlands 61, Mass



HARDNESS TESTER ATTACHMENT permits measurements in such inaccessible places as the groove of a sheave. Pressure is transferred from angle attachment (shown here on a King portable Brinell hardness tester) so that full load of 3000 kg is applied through a 10-mm ball. Resulting impression is read with a microscope—*King Tester Corp, Philadelphia, Penna*



Wire Straightening and Cutting Machine Has Flying-Shear Cutoff

The Model 12A Transit-Cut Hi-Speed automatic machine, reported to be the first completely synchronized flying-shear-type wire straightening and cutting machine, straightens and cuts to length wire from 16 gage to ¼-in. dia on the run, thereby eliminating any marking or swelling of the wire.

Machine incorporates same basic features as company's Model 2A, a Reeves variable-speed drive, roll-type clutch, electric gaging and tripping mechanism, piano-type mounted shutter bar, and two driven feed housings. Unit is also available as a roll-type straightener for square or rectangular wire, ¼ in. square or equivalent area.

Geo C Patterson Machine Co, 3409 Trumbull St, Cleveland 15, Ohio

Ultrasonic Processing Tanks Are Available in 5- and 8-gal Sizes

New 5- and 8-gal Sonitanks reportedly offer extremely high efficiency operating at a resonant frequency of 20 kc. Attaching the reinforced transducer elements by riveting results in increased energy conversion.

Tanks are designed for cleaning, degreasing, pickling, and electroplating operations. The 5-gal model (illustrated), designated T-5, operates with the Model GU420 400-watt 20-kc generator. The T-8 tank uses a Model GU720 700-watt 20-kc generator.

Treatment chambers are made of type 302 stainless steel and are equipped with inlet and outlet drains to allow for recirculation and filtering of the liquid.

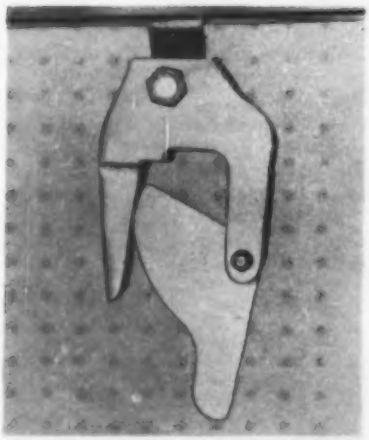
General Ultrasonics Co, 67 Mulberry St, Hartford 3, Conn

New Double-Drive Unit Added to Line of Automatic Rivet Setters

New Model 109 has been added to line of double-drive, adjustable-center rivet-setting machines. Also on display will be the company's multi-head riveter, which will demonstrate the setting of two or more rivets simultaneously.

Tubular Rivet & Stud Co, Quincy, Mass

Metal Show | in print

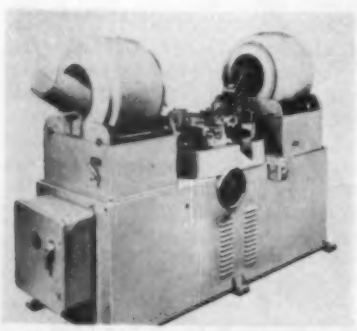


Chainveyor Develops Cam-Action Carrier for Overhead Conveyor

Newly developed cam-action carrier, designed to hold a wide variety of flat materials, holds and carries single loads up to 30 lb without marring surfaces or finishes. Instant automatic or manual release is obtained by simply applying a slight pressure on the cam arm extension.

Also on display will be a full-size conveyor demonstrating combinations of vertical up and vertical down curves with horizontal curves. A combination of power and free-line operation will also be displayed. A new planning folder for conveyor systems will be distributed.

Chainveyor Corp, Los Angeles 22, Calif



Planetary Thread Rolling Machine Features Continuous-Ring Die

Model 125A thread rolling machine has several new features including cradled hopper, rear end loading, and a new feed track assembly with micrometer-type positioning adjustments. The continuous-ring die is mounted on the spindle on an expanding mandrel. This die reportedly can be trued to within 0.001 TIR in less than 15 minutes time. Production rates range from 600 to 800 pieces per min.

Also available is the Model 300, specially designed for thread rolling on hollow parts. A mandrel, which is synchronized with the die, projects into the hollow piece and supports it during the rolling operation.

Prutton Corp, 5295 W 130 St, Cleveland 30, Ohio

Hot Spray Package Unit Is Self Contained and Portable

Completely self contained, the Chieftain series combines the Spee-Flo hot spray heater and reciprocating pump in a portable unit which carries the original 5- or 10-gal paint container. It is designed for industrial and maintenance painting requirements where long hose lines and portability are required.

The 600 and 900 series models are equipped with a 2-kw or a 3-kw heater and a pump designed to spray up to one gallon per minute. A larger series Chieftain offers a similar assembly on a 4-wheel cart carrying a 55-gal paint drum.

Spee-Flo Co, 720 Polk, Houston, Texas

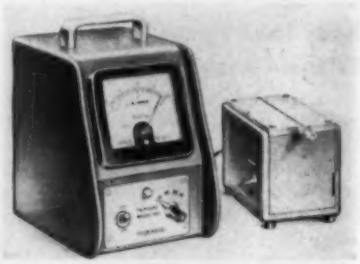
Automatic Die-Casting Machine Produces Zinc Castings up to 1 lb

British-made DCMT Ram automatic die-casting machine requires no operator and will produce zinc-alloy castings from 1 oz to 1 lb in weight at production rates exceeding 1500 shots per hr.

Machine features automatic cycling, an automatic die cleaning device that brushes flash off the die, automatic die lubricating system, and an electronic ladling device that automatically supplies molten metal, on demand, from the preheat furnace to the machine pot.

The die opening is 5½ in.; die locking pressure is 60 tons. The 15 x 11½-in. platen takes all existing DCMT die blocks.

British Industries Corp, Port Washington, LI, NY



Semi-Automatic Surface Tester Covers Wide Finish Range

The Taylor-Hobson Talysurf 100, a British-made surface roughness gage, comprises a motorized pick-up unit incorporating the work table and a motor unit which indicates surface finish as a CLA reading with 0.03 in. cutoff. This "center line average" reading is the index of all irregularities coming within a prescribed length of surface.

It is designed as a workshop instrument to work on a wide range of parts of medium or fine finish. Main features are simplicity and speed of operation, freedom from operating errors, accuracy and repeatability of readings.

Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill

FACE MILLING CUTTER uses economical throwaway inserts which need no re-grinding, as they are used until dull and then discarded—*Vascoloy-Ramet Corp, Waukegan, Ill*

Your Guide to the

39th METAL SHOW

Presenting... the latest in metals, their production, fabrication, processing, testing and application

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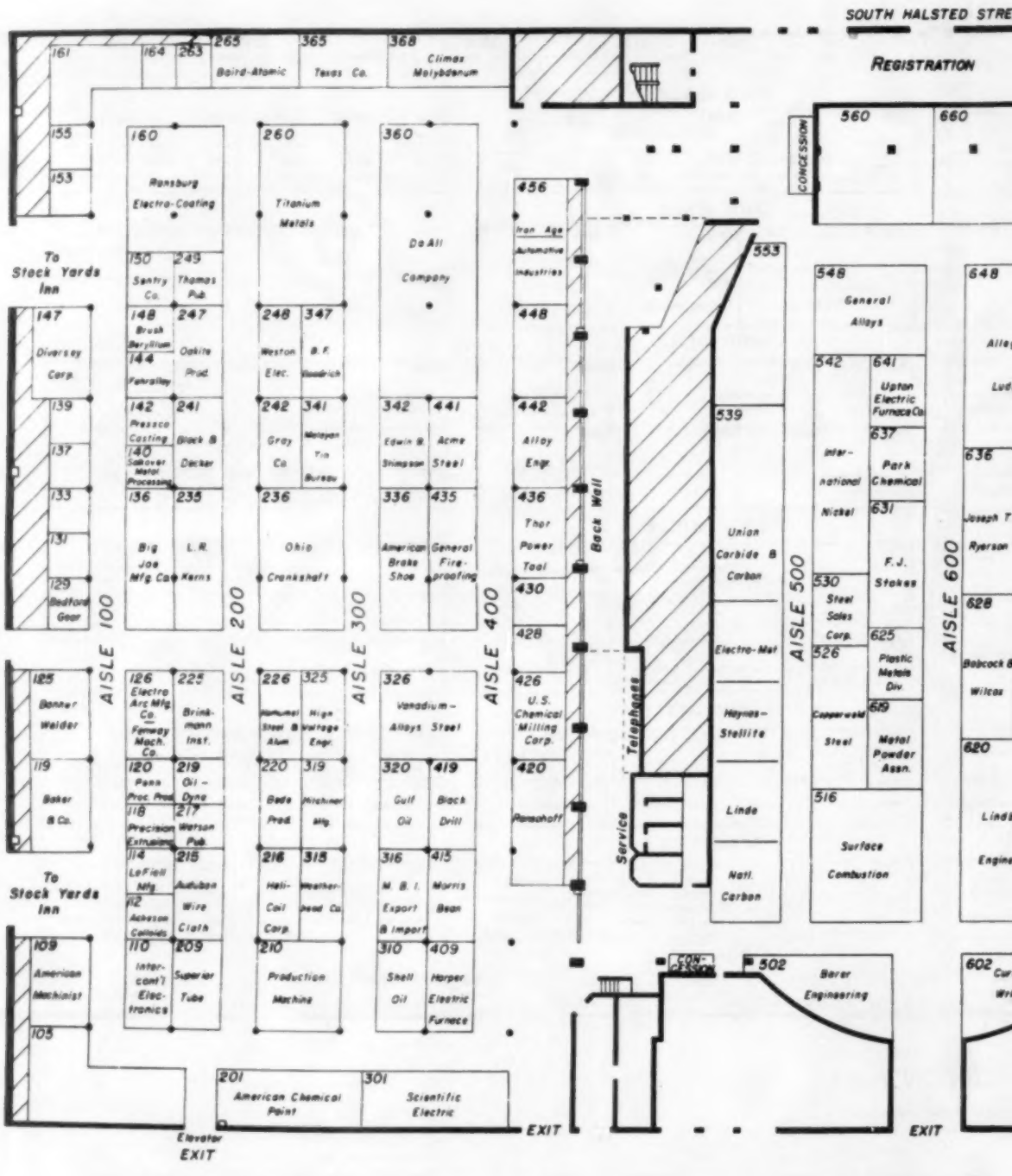

International Amphitheatre, 43rd &

November 4 to 8, 1957

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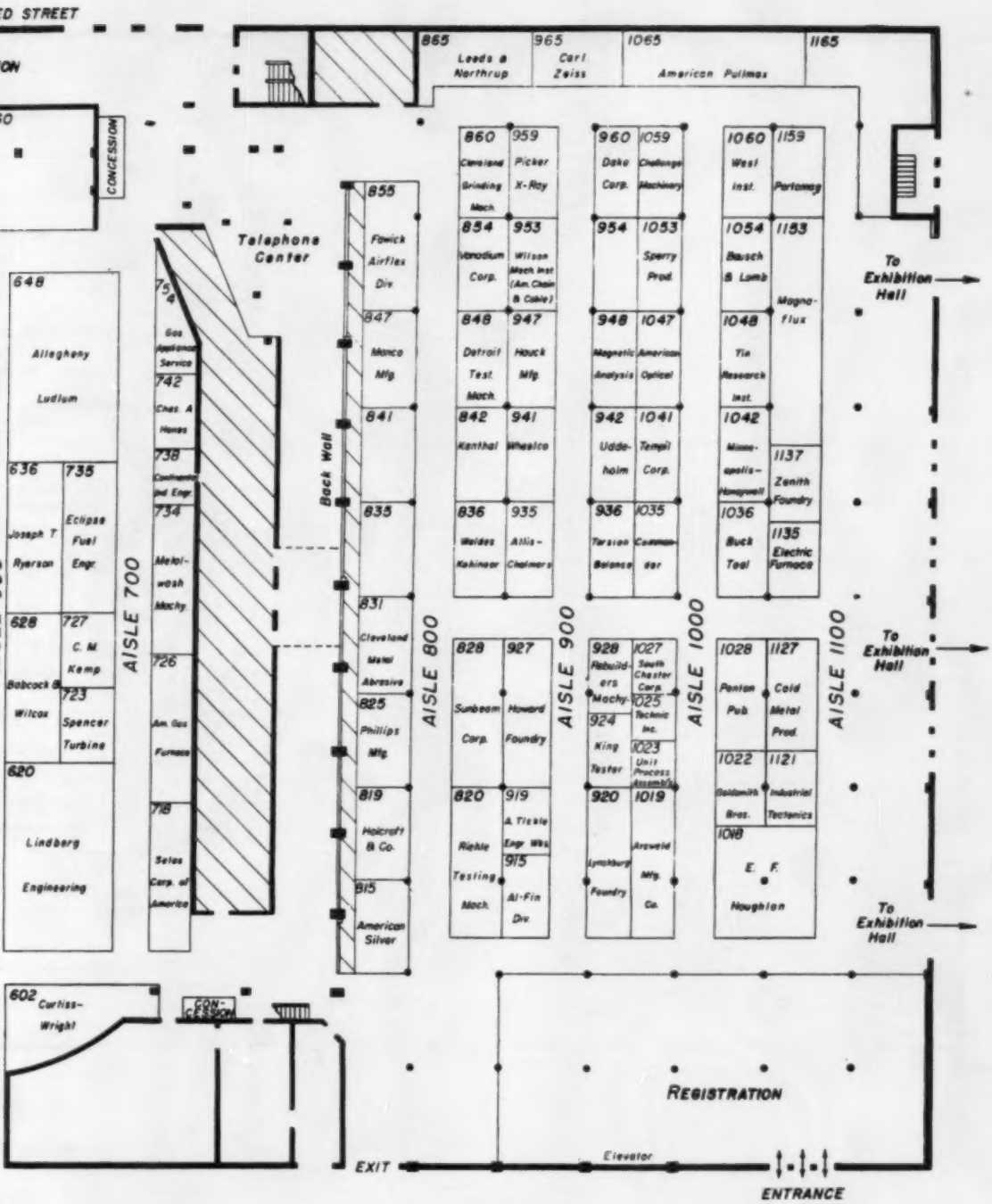


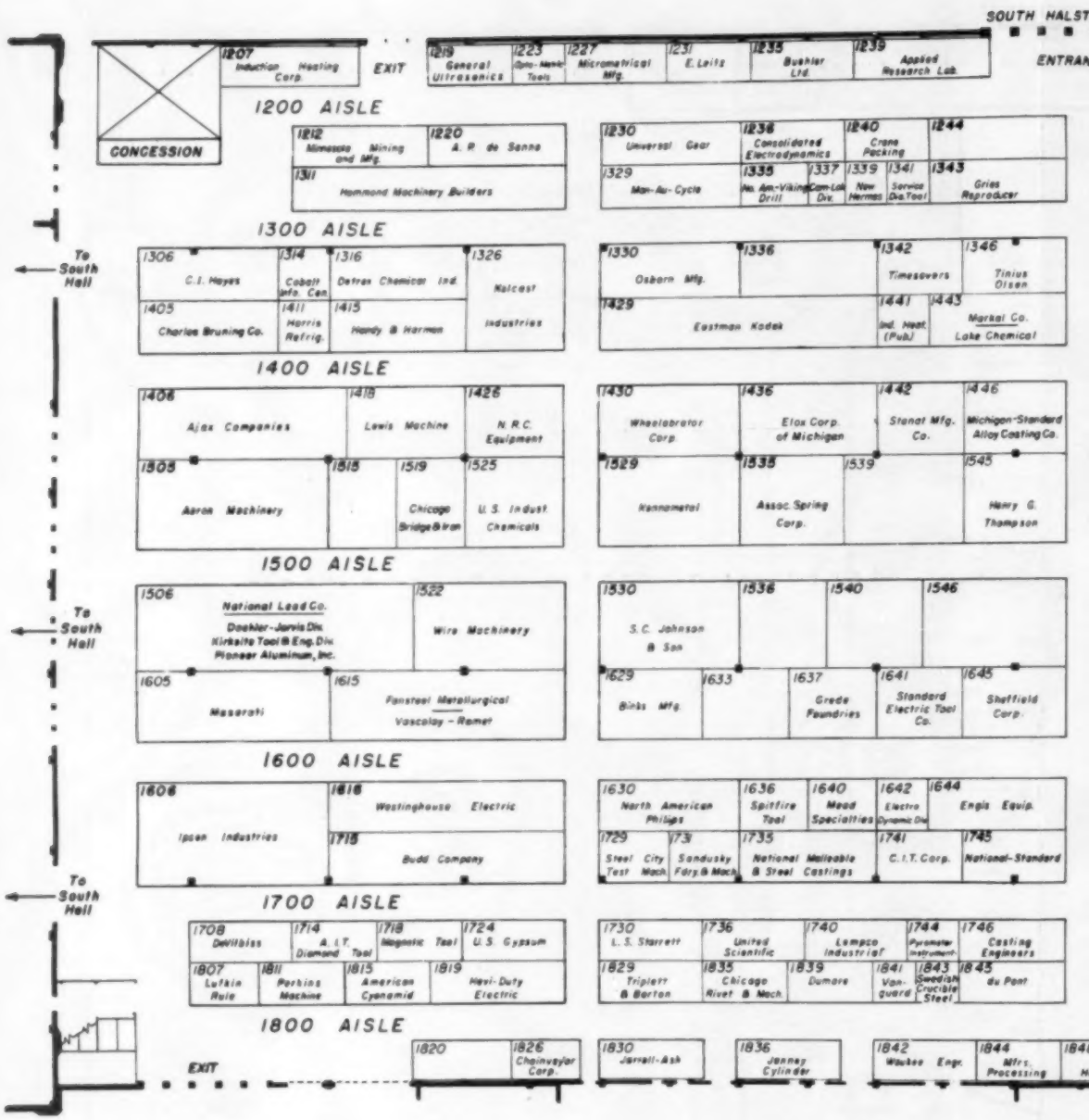
SOUTH HALL

IA
VENUE

& Halsted Streets, Chicago, Illinois

n, Tues, Wed . . . . . Noon to 10:30 PM

urs, Fri . . . . . 10 AM to 6 PM



EXHIBITIO

DEXTER PARK

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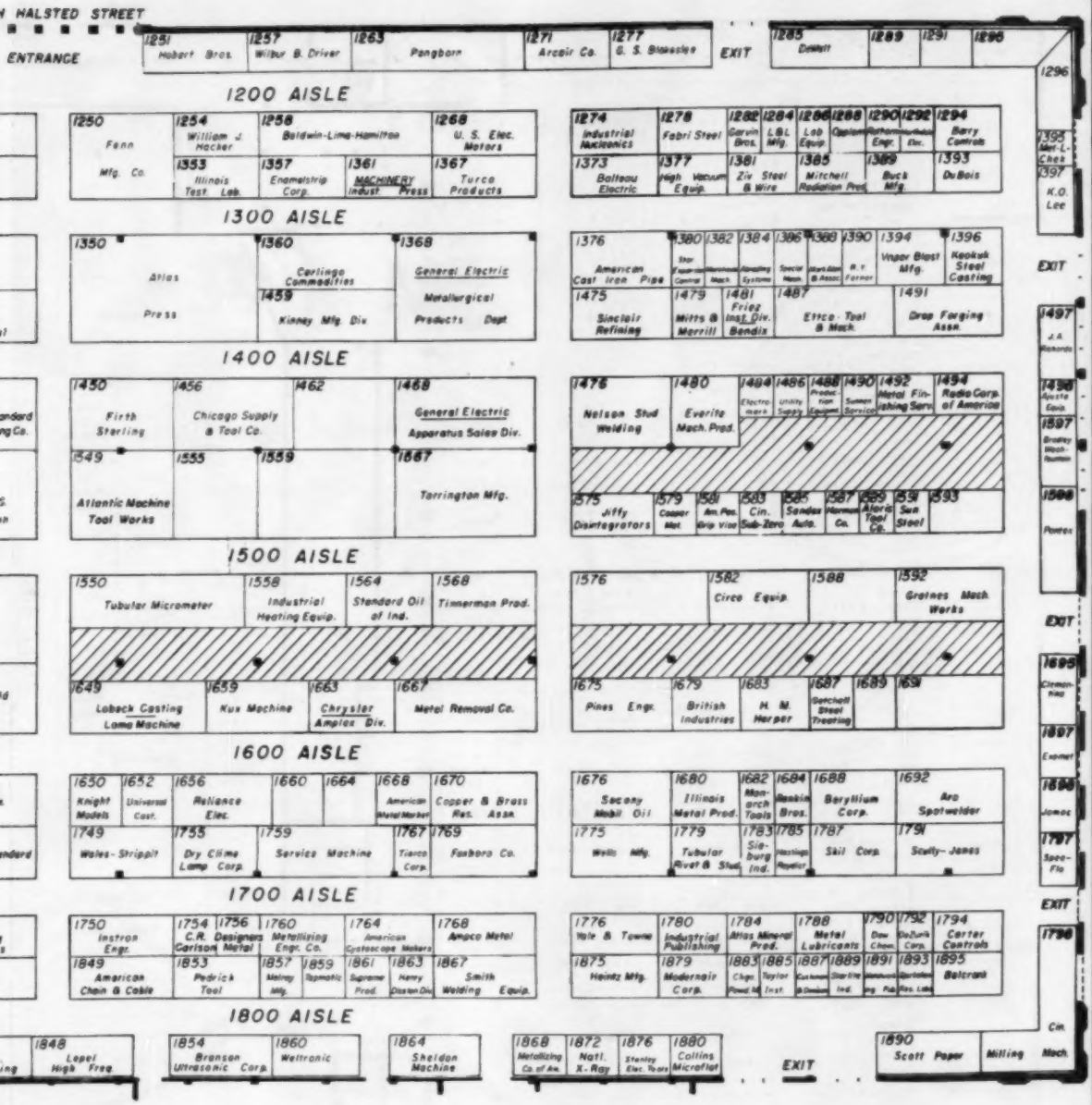

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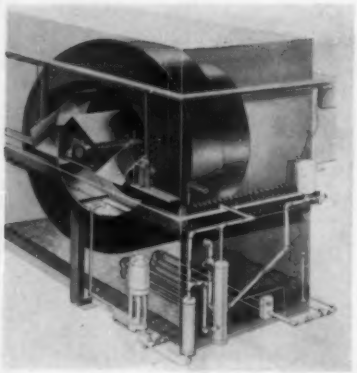


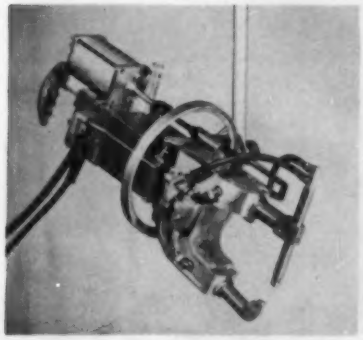
Unit Combines Solvent Degreasing With Automated Work Handling

Model 1DD750 rotary drum degreaser combines solvent degreasing with automated work handling to provide in-process cleaning, cleaning before heat treatment, cleaning before plating and dipping. Unit handles such items as nuts, bolts, fasteners, stampings and screw machine products.

Steam heated and measuring only 6 ft 6 in. wide and 6 ft high, and 4 ft in direction of work flow, unit is compact enough to be usable where space is at a premium. It handles 5 cu ft per hr with a rated capacity of 2000 lb of steel or brass per hr.

Parts to be cleaned enter via conventional chute. They are carried through degreaser by a screw-type drum which gently tumbles the parts, subjecting them to vapor and immersion cleaning and final vapor rinse and drying. Parts are then discharged through chute on other side.

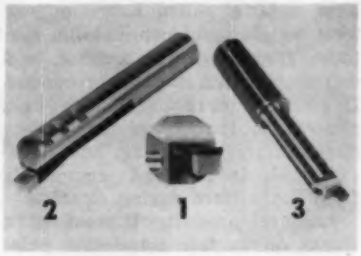
Detrex Chemical Industries, Inc, Detroit, Mich



Gyroscopic Suspension Makes Welding Gun Highly Flexible

Model 410 is a semi-automatic, air-controlled welding gun designed for fast production runs. The unique gyroscopic suspension permits easy rotation through 360° in all directions, allowing welding in close quarters. An electro-mechanical holding device prevents errors of judgment and locks the gun during the pre-set weld cycle. Jaws are opened and closed by the pneumatic cylinder mounted on the back of the gun. Other features include a control for regulating stroke, interchangeable carriers and electrode tips, and adjustable welding pressure. Unit is water cooled.

Guthery Machine Tool Corp, Aro Spot Welder Div, 38-31 Crescent St, Long Island City 1, NY



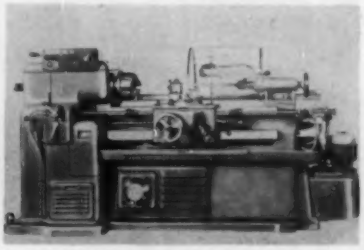
Extra Rigidity Permits Boring Bar to Take Heavier, Faster Cut

New boring bar is designed to provide greater rigidity for heavier, faster cuts—with standard and carbide-tip cutters—and to handle boring and counterboring with one tool.

Front view (1) shows how cutter overhang is minimized to increase strength and rigidity; side view (2) shows locking screws. Illustration at right shows adjustment screw for close tolerance work.

There are 30 sizes available ranging from max-min capacities of 1 1/32 to 25/32 in. up to 6¼ to 5 1/32 in.

Buck Tool Co, 2015 Schipper Lane, Kalamazoo, Mich

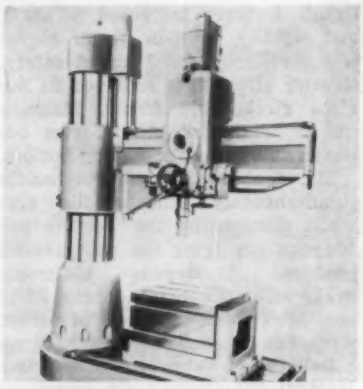


Thread-Cutting Lathe Features Higher Cutting Speed

The new Man-Au-Cycle Hydro-Magnetic single point thread-cutting lathe, said to be the world's fastest for long or short, internal or external work, handles threaded lengths of up to 32 in., has a lead capacity of 0.0250 to 2.00 in. and a 13-in.-dia swing. The hole through the headstock has been enlarged to 2 in.

Other features include cutting speed up to 400 lineal ipm for ceramic tool operation; electro-magnetic clutch and brake; single control switch for stop, start and neutral; hydraulically controlled tool cycle, taper attachment, facing, cutoff, turning and tracing attachments. Air-operated and chucking equipment includes pneumatic tailstock controls and self-centering chuck.

Man-Au-Cycle Corp of America, 132 53rd St, Brooklyn, NY



Radial Drills Feature Electric Pushbutton Controls, Preselector

New line of Italian-made Speedmaster radial drills features preselectors, electric pushbutton controls, and "feather-touch" handling. Line ranges in size from 3 ft x 11 in. up to 12 ft x 28 in.

The 4-ft x 15-in. model illustrated has eight feeds and twelve speeds from 43 to 2400 rpm. Both power and hand feed are possible. Spindle can be stopped instantly by the electro-magnetic brake. A pushbutton conveniently located on the head unlocks the spindle for tool changes while machine is under power and in gear. A light pressure on the clutch handle instantly reverses the spindle during tapping operations.

A new universal cylindrical grinder, the Elgin Model R-7 (Italian), will also be on exhibit. It is available in two capacities, 13 x 40 in. and 13 x 60 in., with or without plunge-cut feed and automatic sizing.

S & S Machinery Co, 140 53rd St, Brooklyn 32, NY

Metal Show | in print

Heavy-Duty Radial-Arm Machine Cuts Nonferrous Metals, Wood

The new Imperial line of radial-arm wood and metal cutting machines features increased strength and rigidity, built-in power elevation mechanism, and added safety. Greater strength is achieved in the rigid steel table frame. Machine has a maximum 16⅞-in. rise between table top and motor bottom.

The double-acting control handle simultaneously unlocks the arm while disengaging the locating pin for changes from cutout to miter positions. A dynamic electronic brake stops the blade approx 20-25 sec after shut-off. Set of arbor wrenches is furnished with machine.

DeWalt Inc, Subsidiary of American Machine and Foundry Co, Lancaster, Penna

Automatic Brazing Machine Features Rotating Dial Conveyor

Automatic brazing machine uses company's Gradiation heating process for silver brazing and similar joining operations. Cigarette lighter components are joined at production rates on a continuously rotating conveyor. Parts can be brought to temperature in 15 sec by four Du-radiant gas-fired burners, permitting a production rate of 1500 parts per hr.

Also exhibited will be the new Series F Flo-Scope for accurate continuous measurement of air and gas flow rates; gas-fired selective hardening of gear teeth; high-speed in-line heat treatment of bars and tubing; and automatic heat treatment techniques.

Selas Corp of America, Dresher, Penna

Coating Material Protects Metallic, Non-Metallic Surfaces

New material called Fabrifilm protects metallic and non-metallic surfaces from abrasion, scuffing, and corrosion during in-plant processing. It is applied on receipt of raw stock, allowed to remain on the surface during storage, forming, and fabrication. It is removed completely from the surface during cleaning.

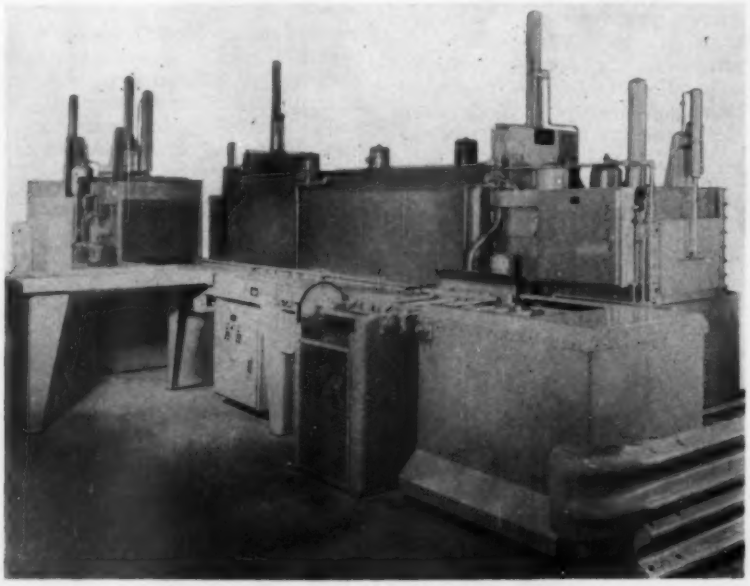
Another product, Turcoat 4178, works on surface conversion principle and provides aluminum with an ornamental, paint-gripping, corrosion-resistant coating.

Turco Products, Inc, Terminal Annex 2649, Los Angeles 54, Calif

Lightweight Stud Welding Gun Has Capacity of ½-in. Diameter

New small stud welding gun weighs less than 4 lb and is 9 in. long. Called the Nelson NS-10, the durable, red plastic gun will weld all studs up to ½-in. dia. It uses company's standard line of studs, ferrules and welding accessories. Also on exhibit will be the NS-9, which welds larger studs up to 1-in. diameter. Guns are reported to increase productivity and reduce operator fatigue.

Gregory Industries, Inc, Nelson Stud Welding Div, Lorain, Ohio



PRODUCTION FURNACE, B-Model P-6-3030 Pusher Tray furnace, features integrated oil quench, and self-purging charge vestibule. Unit can be used for neutral bright hardening, bright gas carburizing or carbonitriding. When built for carburizing, the first zone has initial heating capacity of 1000 lb steel per hr; two additional zones afford soaking interval control, and all zones have full forced-circulation heating—*Ipsen Industries, Inc, 715 S Main St, Rockford, Ill

V-R CARBIDE INSERTS

...A Style and Grade for Every Operation

Standard V-R Grade	Characteristics and Applications
EE	Strength and toughness characterize this grade. It is the strongest of all steel cutting grades. Recommended for rough and interrupted cutting.
EM	A general purpose steel cutting grade with good wear-resistant property.
VR-75	A tough heat-resistant general purpose steel cutting grade. Especially recommended for severe applications where high heat is generated.
E	A hard grade with good abrasion resistance. Recommended for medium and light machining and boring of carbon and alloy steels.
EH	The hardest and most abrasion-resistant steel cutting grade. Recommended for high speed, light finishing cuts and precision boring.
2A5	A grade for general purpose machining of cast iron, non-ferrous metals and non-metallics. It has good strength and superior abrasion-resistance in excellent balance.
2A7	The hardest and most wear-resistant grade for cast iron, non-ferrous metals and non-metallics. Recommended for light, fast finishing cuts and for machining to close tolerances such as required for precision boring.

Standard and Special Throw-away Type and Long Inserts for All Mechanical Toolholders

Standards. Vascoloy-Ramet manufactures and stocks a complete line of standard cemented carbide inserts for straight and lead angle turning, facing, chamfering, profiling, grooving, face milling, planing, shaping, and other operations commonly performed with mechanical toolholders.

Specials. V-R produces custom-made inserts to meet special requirements.

Let your V-R qualified field service engineer show you the economies of tooling with V-R carbide inserts. Call him today, or write. Ask for literature.

See the latest developments in carbide tooling at our Booth No. 1615 at the Metals Show, Chicago, November 4-8.

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

C-642

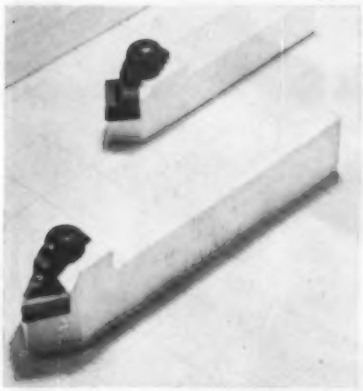
V-R

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

894 Market Street • Waukegan, Illinois

NEW SHOP EQUIPMENT

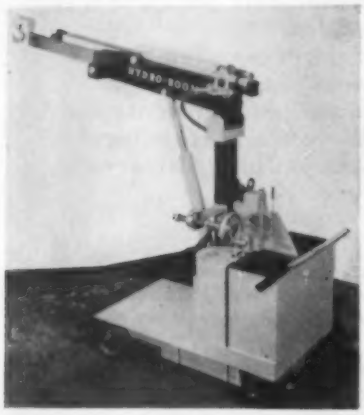


Carmet Improves Toolholder For Carbide Indexable Inserts

New toolholder has an improved clamp that has a positive gripping action and gives greater chip clearance; it can be used with or without the chip breaker. Clamp screw is accessible from both top and bottom of the holder.

Number of different styles has been increased by 26 with addition of positive rake cutting toolholders; previously there were 90 styles and sizes in the negative rake type. All styles and sizes will incorporate the new clamp. Ten new positive rake inserts have also been added to the Carmet line.

Carmet Div, Allegheny Ludlum Steel Corp, Oliver Bldg, Pittsburgh 22, Penna



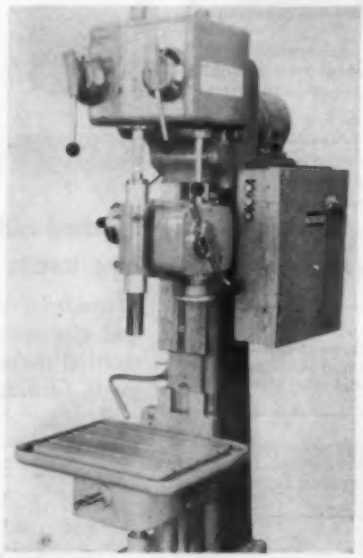
Boom Truck Positions Work Loads To Within 0.01 in.

Hydro-Boom truck, Model 110, with boom movement hydraulically controlled, can by telescopic action position work loads with machine tool accuracy to within 0.01 in., in both vertical and longitudinal directions. Cross-wise movement is easily directed by a hand-operated screw.

Boom reaches up to 48 in. beyond the front end of truck, keeping truck away from area to be serviced. Capacity at max boom extension is 1500 lb, or 2500 lb with boom retracted. Travel of the boom crosswise is 28 in.; longitudinal, 28 in.; vertical, 90 in.

Unit is only 32½ in. wide and is available in hand-operated or battery-powered models with or without power propulsion.

Vanguard Engineering Co, 1908 E 66 St, Cleveland 3, Ohio

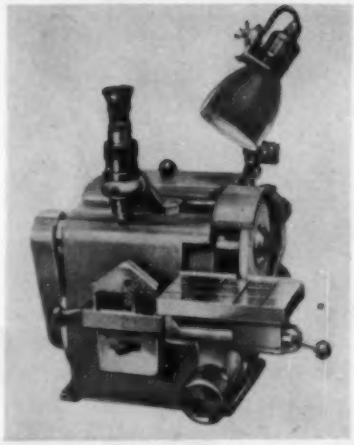


Drilling and Tapping Machine Handles Wide Range of Work

Completely new Model N 21-in.-swing upright drilling and tapping machine is now available in box- and round-column types in both single spindle and gang drill models.

Single lever functional control offers fast, easy handling. Spindle speeds and feeds can be arranged for almost any job. A unique design feature not only permits unlimited feed rates, but also provides all standard geared tap leads from 8 to 50 pitch. Complete line of attachments and accessories available.

Cleereman Machine Tool Corp, 555 W Washington Blvd, Chicago 6, Ill



Drill Grinding Machine Assures Symmetrical Sharpening

Drill grinder, Model SM-3, sharpens all types of drill under ⅛-in. diameter. Drill is clamped in holder and checked under microscope. Holder, which accepts all drills within the size range of the machine, is designed to give absolute symmetrical sharpening of drills regardless of the predetermined tip angle, back-off angle, or whether they are RH or LH drills. A wheel truing attachment is built into the machine.

Unit weighs 55 lb and has a 3-phase, 220-v, 60-cps motor. It is furnished complete with grinding wheel, truing attachment, drill-holder lighting fixture, tweezer, and wrench.

Jersey Mfg Co, 407 Livingston St, Elizabeth, NJ

End Mills are Designed to Cut Non-Ferrous Metals

Fastlead series end mills are specifically designed to cut aluminum and other non-ferrous metals. Tools are available in regular and long-length models in diameters of ¼ to 2 in. Extra-long-length mills are standard in diameters of ¼ to 1½ in.

Tools are said to perform particularly well in aircraft-forging tracer milling and in slabbing, cavity and deep-pocket milling in both soft, non-ferrous materials and the harder alloys. New flute design and high helix angle are said to insure positive chip removal while a new type relief is claimed to afford stronger, more durable cutting edges.

Whitman & Barnes, 40600 Plymouth Rd, Plymouth, Mich

Ready, Set, GROW... with

The *economical* way to make your products strong, light and handsome is with Revere Aluminum Sheet. Economical because aluminum is so easy to handle and process, can so readily be given a surface finish of distinction.

Revere can serve you promptly now from plants in the East and Mid-West, and soon will be fully integrated as a primary aluminum producer. Revere Copper and Brass Incorporated. Founded by Paul Revere in 1801. Executive Offices: 230 Park Avenue, New York 17, N. Y.

Revere Aluminum Mill Products include coiled and flat sheet, both plain and embossed; circles; blanks; Tube-In-Strip; extruded products; seamless drawn tube; welded tube; rolled shapes; electrical conductors; forgings; foil; frozen food containers. Write for new illustrated booklet on Revere Aluminum Sheet. Free!

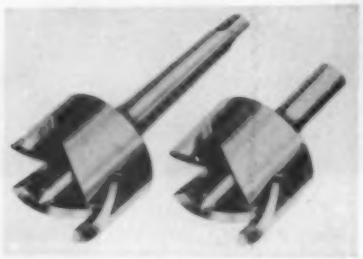
Morrison Keyseater Offers Automatic Feed Stop and Relief

Machine called Keyseater cuts keyways from 1/16 to 1 in. The work is fed into cutting tool and the single cutter takes the cut the full length of work before backing out and relieving itself. Automatic feeds, 0.002, 0.004, 0.006 in., eliminate the need for pushing a feed bar. Automatic stop cuts off the feed for any given depth. On the up stroke the cutter is automatically relieved to prevent drag.

All control handles are built into machine. Setup is quick; different cutter bits are interchangeable. All cutters are of single-tooth type and are made of high-speed steel.

Stroke is adjustable from 6 to 9 in. Machine also features automatic centering. A taper attachment can be supplied for cutting tapered keyways. Motor drive and electrical equipment are built into the machine and include a 1½-hp geared motor, magnetic switch, and a start-stop-jog pushbutton station. Floor space required is 32 x 36 in.

D C Morrison Co, Cincinnati 1, Ohio

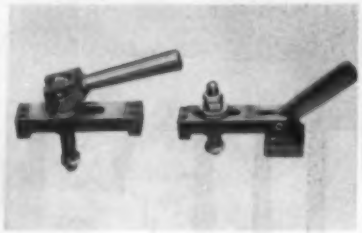


Cutters Produce Concentric and Practically Burr-less Holes

New Roto-Bor, utilizing four cutting lips instead of two as in previous model (*AM*—Jan 14 '57, p188), is counter-bored to increase its cutting speed, cutting depth, and ease of re-sharpening. Available in sizes from 13/16 to 2-1/32 in. Cutters, available with No. 2 Morse taper shanks in the sizes from 1 to 1-9/32 in. and with No. 3 Morse taper shanks in sizes from 1-5/16 to 2-1/32 in., are also available with ½-in. straight shanks.

Designed to produce concentric and practically burr-less holes in sheet and plate materials up to ¼ in. thick, cutter performs equally well in ferrous and non-ferrous materials, plastics, or hardboard. An axially retracting center point assures accurate positioning as well as eliminating the need for guide bushings.

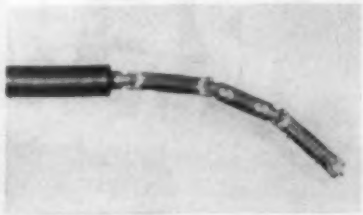
Jancy Engineering Co, 508 S Pine St, Davenport, Iowa



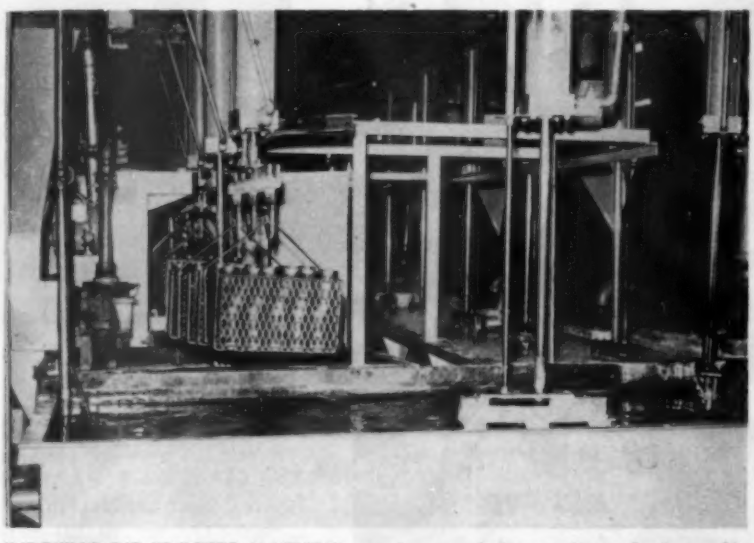
Strap Clamp Assemblies Feature Interchangeable Pads

New strap clamping assemblies feature a universal-type strap milled from solid stock and five, soft-stock, interchangeable pads. The pads can be arranged for perfect fit on any shape work surface and offer secure downward pressure at all times. Pads are attached to strap by two screws; brass and bronze pads can be used for very soft work. Clamps are available in a wide range of sizes and designs including a variety of nut-and-bolt-type assemblies for heavy-duty work and cam types for light applications.

Jergens Tool Specialty Co, 712 East 163 St, Cleveland 10, Ohio



FLEXIBLE LINK SHAFTS consist of trunnion blocks and two half links fastened together with screws or rivets. They are available open or sheathed depending on job. Applications include continuous universal joints, remote control, flexible shafts, power drives, and couplings. They are available in brass (¼ to 1½-in. dia) and steel (⅜ to 3-in. dia). Minimum link length is 3 times link dia; max length 20 ft—*Clark Flexible Link Shaft Co, PO Box 73, Newton Highlands 61, Mass*



INDEXING DIP PROCESS MACHINE permits use of shorter dip tanks for multi-stage finishing operations. It dips baskets of parts into a series of tanks as baskets travel suspended from a single, closed-loop monorail conveyor. Operation is automatic, from first dip through conveyor unloading. Unit can be adapted to any finishing requirement.—*Cincinnati Cleaning and Finishing Machinery Co, Hageman St, Cincinnati 4, Ohio*

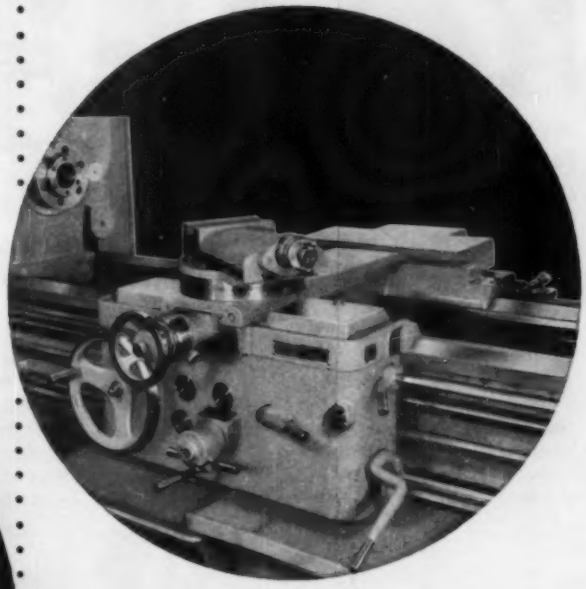
no other lathe shifts as easily and quickly as...

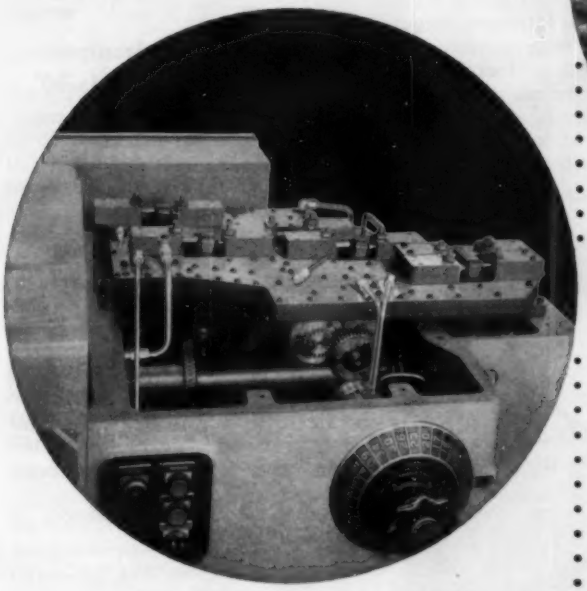
SIDNEY
DIAL-MASTER
LATHE
MODEL 32

FROM SPEED TO SPEED IN 2 SECONDS OR LESS!

A flick of the control lever and you change to any speed through the hydraulically actuated shifter mechanism. The all-herringbone geared headstock provides 32 pre-selective spindle speeds (this was introducted FIRST by Sidney in 1947) in geometric progression all obtained by the rotating dial control. Think of the time and effort saved!

In addition, you get great strength and smooth operation in the headstock. The herringbone gears eliminate end thrust and provide longer life due to the opposed helix angle and greater tooth engagement.





32 PRE-SELECTIVE SPINDLE SPEEDS

SINGLE LEVER CONTROL CARRIAGE AND APRON

No complicated mechanism to worry about. Control for both standard longitudinal and crossfeed as well as 4-way rapid traverse is through a single lever which actuates positive serrated jaw plates. Safety overload feature is provided. Interlocking mechanism prevents use of the feed gearing when half nuts are engaged. Built-in thread chasing dial is mounted at angle convenient to operator's vision.

Write for new bulletins or for representative to call

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

Injection Molding Machine Has Push-button Controls

Model 50 "air-Jet" Wasp, latest in company's Mini-Jector line, is said to eliminate high costs and complexities of big-press tooling for intricate, small plastic molding over metal inserts. Unit will mold all thermoplastics, including nylon. Maximum pressure is 30,000 psi. This pushbutton model features a V-type mold with interchangeable cavity cell. After each cycle, mold block ejects automatically for removal of molded item and easy placement of insert. Colors are changed without loss of time. Interchangeable cylinder-ram heater box assemblies offer a capacity range of 1/3 to 1 oz.

Newbury Industries, Inc, Newbury, Ohio

Kelite Introduces Series of Direct-Fired Steam Cleaners

Each of new steam cleaners provides a positive displacement pump capable of delivering its full rated output hundreds of feet from machine; an efficient water-wall heat exchanger; and a gas or oil burner which provides instant starting.

Mark I, designed for light to medium duty, has an output of 120 gpm. Mark II, for medium to heavy use, has a 200-gph output. Mark III, with an output of 300 gph, is designed for maximum duty. All are rated at 320 F.

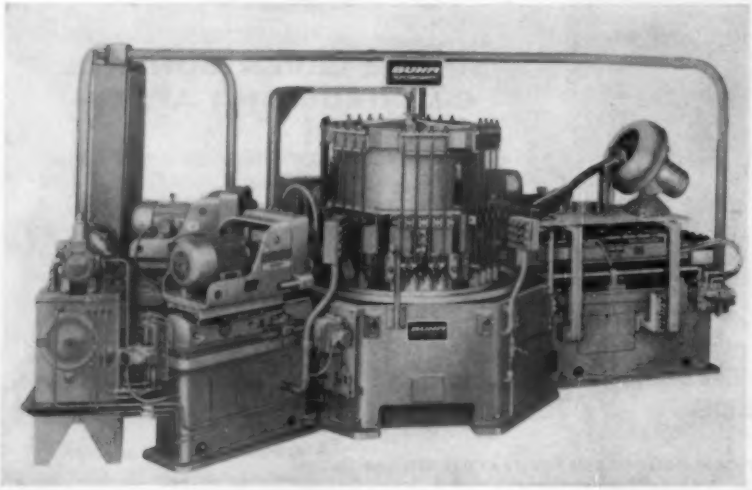
Standard equipment includes one heavy-duty steam cleaning gun, a high-velocity nozzle, and a heavy-duty hose. Full line of accessories available.

Kelite Corp, 81 Industrial Rd, Berkeley Heights, NJ

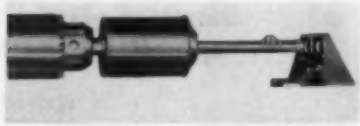
Magnetic Conveyor Transports Ferrous Loads at Angles to 90°

New magnetic belt conveyor transports ferrous loads at angles up to 90°. In handling steel tote boxes and ferrous parts or products, either unpackaged or in cardboard containers, the conveyor's steep angle of inclination saves valuable floor space. Loads are carried on a thin, rough-surface belt which moves over a metal bed containing permanent Alnico magnets. Because belt must be slack to conform to the lower vertical curve, unit is powered by a positive-acting drive consisting of a right-angle gearhead motor with a roller-chain drive to the conveyor headshaft.

Alvey-Ferguson Co, 1705 Disney St, Cincinnati 9, Ohio



STEERING GEAR COMPONENTS are machined and assembled at the rate of 489 pieces per hr on this Economatic. Operations are as follows: manually load four pieces and automatically power clamp; spotdrill for countersink; drill through for ream; end cut ream to straighten hole; size ream; press in pin; automatically unclamp and manually unload pieces—*Buhr Machine Tool Co, Ann Arbor, Mich*



New Noburmatic "H" Tool Is Automatically Actuated

Tool that functions with positive mechanical action deburrs and chamfers both front and back sides of

General Mills said it about the Lindner Optical Jig Borer

"Machine time on the Lindner was 32 hours. Estimated time on any other machine or combination of machines in the shop was at least 64 hours, with serious doubts that the quality would have been as good."

The Job:

Machining an optical test fixture for checking the hemisphere sight for the MD-9 Tail Defense System, used in the B-52 Bomber.

The Specs:

1) Locating and boring bearing holes to ±.0002, −.0000; 2) Locating and boring 49 additional holes for mounting optical lenses; 3) Milling a flat surface with first class microfinish around each hole to an angular position within ±2 minutes.

The Machine:

Lindner Optical Jig Borer, Model LB15A, with preselective Autopositioner®, used throughout for all locating and machining.

need we say more?

Learn why Lindner Optical Jig Borers have changed so many ideas about jig boring. Send for a 25-minute movie film demonstration without obligation.

Lindner Optical Jig Borers are available in two models: LB15A with Autopositioner—Table size 44" x 24"; LB14—32" x 16" (without Autopositioner)

KO CO., INC. PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

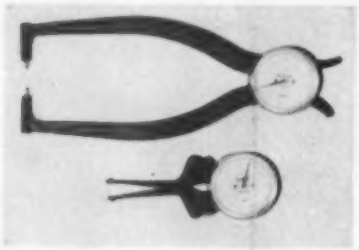
35 Exchange Place, Jersey City 2, N.J. • In Canada: 2490 Eglinton Ave. W, Toronto

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

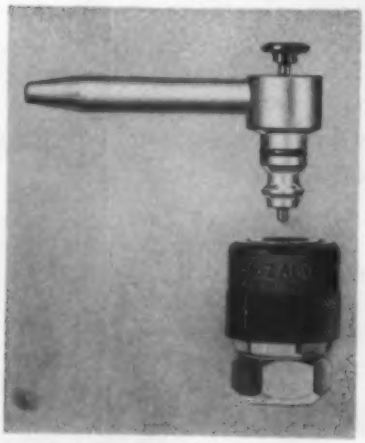
holes (1) where manufacturing procedure is facilitated by a tool that will finish both faces from a single entry without need for reversing the part; (2) drilled into a blind cavity where the back face is not openly exposed; (3) line drilled through two or more parallel walls.

Unit can be used in mechanized or automated machine tool, or manually in conventional drillpresses and in sequence with drilling operations. It is available for whole sizes ranging from ¼ to ¾ in. and for working depth from 1½ to 3¼ in.

Nobur Manufacturing Co, 6860 Farmdale Ave, N Hollywood, Calif



DIAL CALIPERS, tradenamed Quicktest, are made in Germany and are available in outside and inside models. The outside model is graduated in 0.0025-in. divisions and has a range of 0 to 1 in.; inside model measures from 0.40 to 0.80 in. in 0.001-in. divisions—*Imported and distributed by Titan Tool Supply Co, Inc, 1419 Hertel Ave, Buffalo 16, NY*



Snap-Action Air Gun Has No Valves or Springs

Lightweight air gun, made of machined steel parts, has no springs, valves, or rubber seals. A rubber O-ring, which has no sealing function, is the only rubber part. It is available in two models, Series 254 and 255, to fit many existing air line connections. Gun fits Zalo 250, 255 and PT couplers.

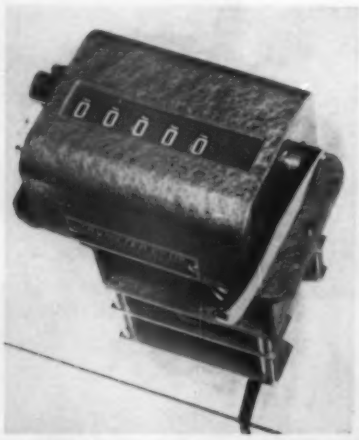
Zalo Mfg Co, 4893 Van Epps Rd, Cleveland 9, Ohio

Beckett-Harcum Offers Compact, Fast-Acting Fixture Clamp

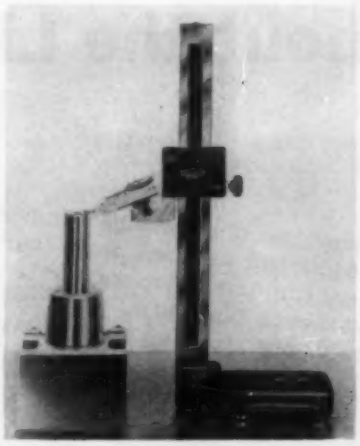
Complete fixture-clamp power package, known as Valve-N-Cylinder, can be used for clamping, locating, or pushing-off parts on production operations. It consists of a square-rod (non-rotating) air cylinder on which is mounted a 3-way electric valve. Foot, hand, or limit switches may be used to energize the valve. Valve operates on 110/220v, 60 cps.

Valve and air cylinders are easily separated and may be used separately, if so desired. Unit is available with 1, 1½, and 2-in. bores; 1, 2, 3, and 4-in. strokes. Literature available.

Beckett-Harcum Co, 1087 Wayne Rd, Wilmington, Ohio



TIMER UNIT, made in England, consists of a pre-determined counter coupled to a special synchronous motor. Unit can be supplied to record up to 99,999 hr and can be used to shut down machines for periodic inspection and maintenance. It has many applications in time study—*Trumeter Co, 38 West 32nd St, New York 1, NY*



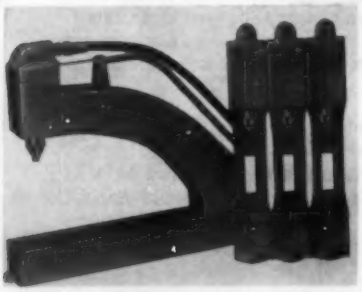
Height Gage is Adjustable to Consistent "Tenth" Accuracy

Check Master height gage is designed as a companion device for company's Check Master test indicator (*AM*—June 18 '56, p188). Because the test indicator responds to dimensional variations as low as 0.00002 in. the height gage has been designed to give consistent "tenth" accuracy.

Desired height is easily set by lifting or pressing at point marked on carriage. One-finger pressure will raise or lower carriage to approximate desired setting—final "tenth" setting is made with fine-adjustment screw.

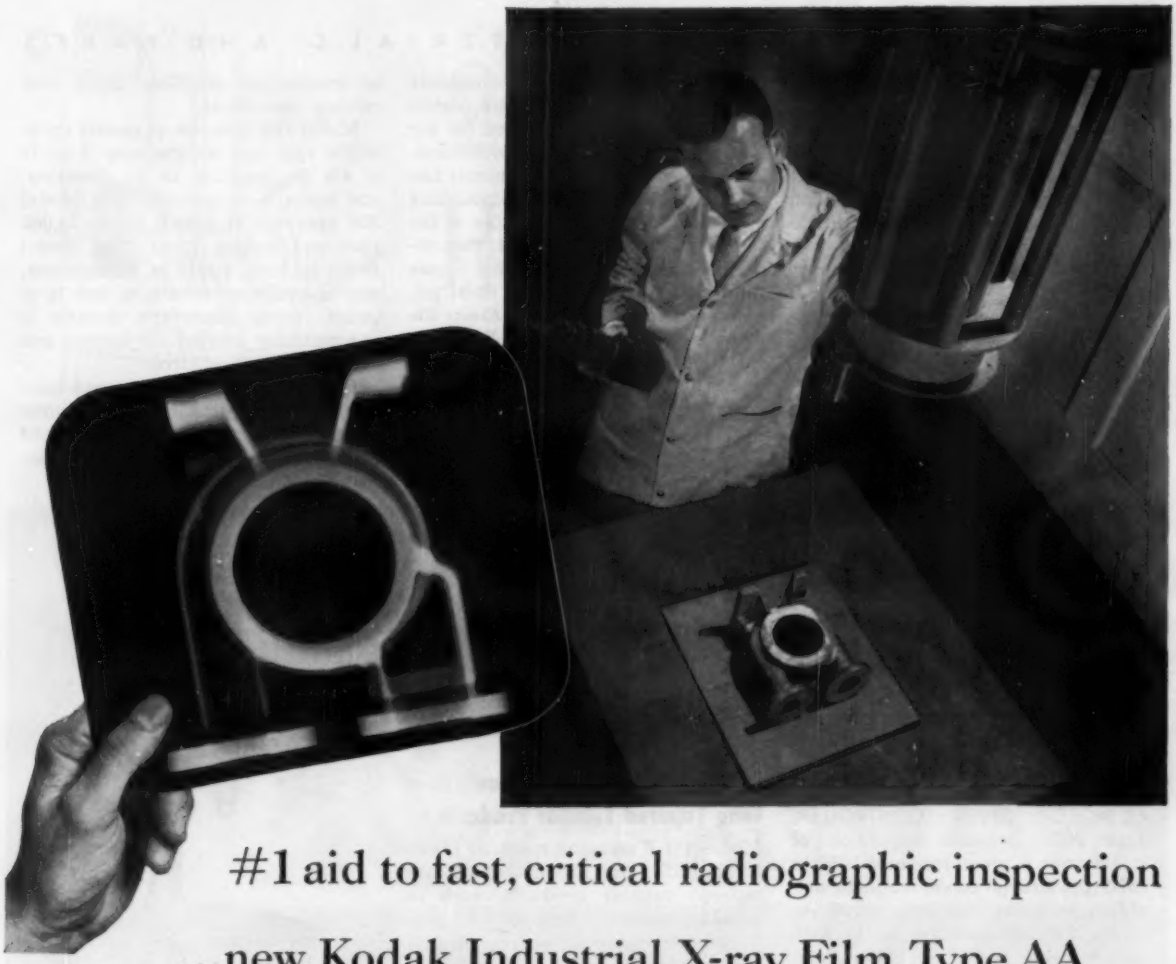
Five rest pads under the base provide maximum wear resistance and low friction. This construction is said to eliminate error from air-cushion action common to ordinary flat-bottom bases.

Standard Gage Co, Inc Poughkeepsie, NY



Air-Operated Impact Hammer Stakes, Swages, Stamps, and Cuts

Air-operated impact hammer, called Airchamp, features a new slim-line design for multiple installation. Unit, which can be used for staking, swaging, stamping, cutting, marking



#1 aid to fast, critical radiographic inspection

...new Kodak Industrial X-ray Film, Type AA

TODAY'S radiographic inspections call for increased sensitivity, greater speed. And these are the characteristics of Kodak's newest industrial x-ray film, Kodak Industrial X-ray Film, Type AA.

This film retains all the excellent qualities that made Kodak Type A the most widely used x-ray film in industry. Then, in addition, it provides greatly increased speed.

This permits exposure time to be cut as much as 50%. It allows adjustment of the radiographic factors to obtain greater contrast and easier readability.

Kodak X-ray Film, Type AA can multiply your minutes—can extend the usefulness of your present radiographic equipment.

Find out all the ways it can improve your production. Get in touch with your x-ray dealer or Kodak Technical Representative.

EASTMAN KODAK COMPANY
X-ray Division Rochester 4, N. Y.

Read what the new Kodak Industrial X-ray Film, Type AA, does for you:

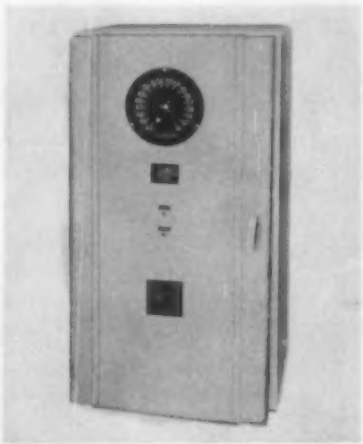
- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under the usual shop conditions of use.

Kodak

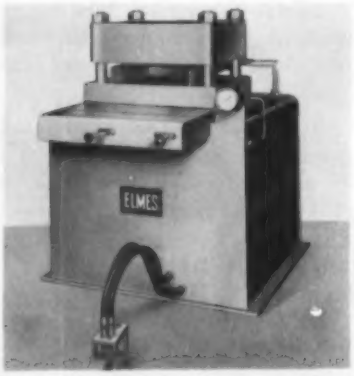
Kodak Industrial X-ray Film, Type AA and Type M is now available in 100-sheet boxes wrapped without interleaving paper. Designated as AA-100; M-100.

and punching, can be set up for multi-stage operation on 2¼-in. centers. As many as 10 units can be operated off a ½-hp air compressor, consuming 1½ cfm, each delivering 50 spm. Hammer has a 2-in stroke, ram height clearance of 5 in., and a 10-in. throat. It sells for $89.50.

High Speed Hammer Co, Rochester 21, NY



AC-MOTOR SPEED CONTROLLER, Type 2027, provides regulation of ± 1% over a speed range of 1050 to 1530 rpm through power magnetic amplifiers in series with rotor-circuit resistors. Cabinet measures 51 in. high 24¾ in. wide and 21 in. deep—*Warren Mfg Co, Littleton, Mass*

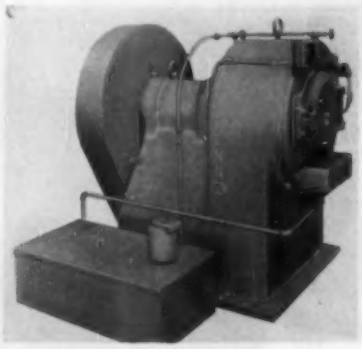


Custom-Designed Elmes Hydrolair Meets Specific Production Needs

Standard Hydrolairs, small, lowcost, pumpless, motorless hydraulic presses for plastics molding, laminating, compacting, are available in 30, 50, 75, and 100-ton models.

Specially designed unit illustrated has a moving-down platen (instead of standard moving-up type) for an assembly operation wherein manual controls operate the pressing platen and a foot switch is installed for actuating an unloading mechanism. Housing containing the controls has been extended to permit mounting a loading and unloading table at the same level as the press bed. This 50-ton-pressure-capacity model uses shop airline pressure from 80-90 psi.

American Steel Foundries, Elmes Engineering Division, 1150-A Tennessee Ave, Cincinnati 29, Ohio



Swaging Machine Produces Long Tapered Tubular Products

Model 4½ F swaging machine greatly simplifies the production of long tapered tubular products, such as tubular furniture legs. It will produce tapers up to 15 in. long on tubing up to 2¼-in. dia in a single pass at a production rate up to 6 per min. This includes welded and seamless tubing of ferrous and nonferrous metals. Work reportedly leaves machine with a fine finish. Unit illustrated is equipped with a recirculating coolant system.

Fenn Mfg Co, Newington, Conn

Pneumatic Die Grinders Perform Intricate Filing and Cutting Jobs

Two midget pneumatic die grinders have been added to company's line of pneumatic production tools. Both grinders are reported to be valuable time savers on intricate tool, die or production grinding, filing and cutting operations.

Model 200 operates at speeds up to 60,000 rpm and weighs only 4 oz. It is 4⅞ in. long, ⅝ in. in diameter, and has a ⅛-in. collet chuck. Model 300 operates at speeds up to 38,000 rpm and weighs 12 oz. This model is 5¾ in. long, 1-1/16 in. in diameter, and is equipped with a ¼ and ⅛-in collet chuck. Push-type throttle is conveniently located for instant and accurate speed control.

Due to operating speeds and ball-bearing construction, manufacturer suggest that air line be equipped with a fog-type lubricator-filter. Bulletin 63.

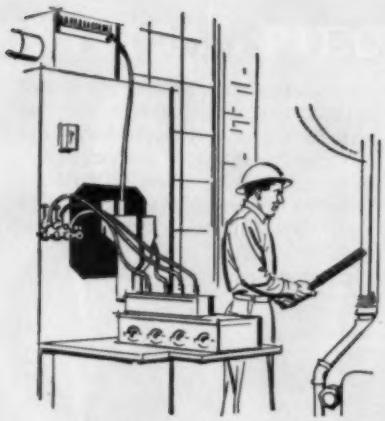
Airetool Mfg Co, 328 S Center St, Springfield, Ohio

Drilling Machine Offered in New Improved Model

New line of No. 15 drilling machines, tappers and accessories retains all the easy-operating and long-life features of the former models, but is more flexible, and easier to operate. Improvements include front-mounted start-stop switch pushbutton, easily-seen speed range table, depth gage, and 3-grip spindle feed. The drilling machines have a capacity (in cast iron) of ½ in. when equipped with a 1/3-hp motor; ⅝ in., with a ½-hp motor.

Five spindle speeds are available; speed range depends on motor. With a 1750-rpm motor, speeds range from 460 to 6300 rpm. Line includes floor, bench, pedestal, and manufacturing-bench-type drilling machines and two tapping machines. Bench and pedestal types are available in 1- to 6-spindle models. Bulletin 4024.

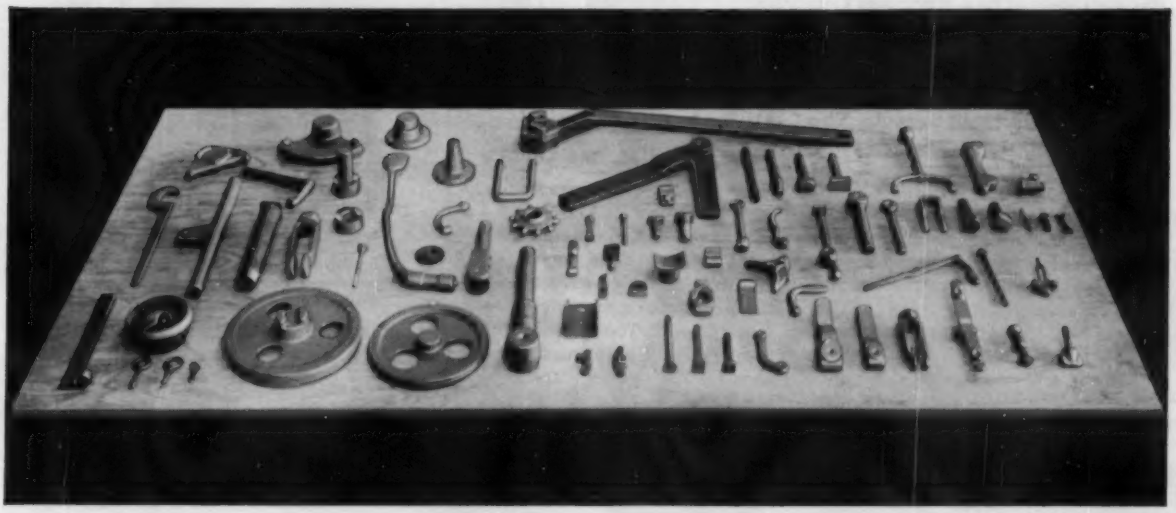
Buffalo Forge Co, 465 Broadway, Buffalo 4, NY



200 Different Parts Heated for Forging-

Better, Faster and at Much Lower Cost

with TOCCO* *Induction Heating*



• When progressive production people at General Railway Signal Company installed a 200 kw, 3000 cycle TOCCO machine, they were able to eliminate 7 slot-type oil-fired furnaces and produce better forgings than ever before—at substantially lower costs.

Cost Down—Fuel costs have been reduced from $15.26 to $1.60 per hour with TOCCO. Expensive furnace lining maintenance has been eliminated, and straightening and reheating operations formerly required are no longer necessary.

With oil-fired furnaces all steam hammer operators needed helpers. With TOCCO most of these helper operations have been eliminated.

TOCCO's fast, automatic operation produces almost no scale and achieves uniform temperatures throughout the entire cross section—improving the quality of the forgings and providing increases of up to 40% in the life of the forging dies.

Overall production costs in the forge shop at G.R.S. have been reduced an impressive 35%!

Flexibility—Production runs at G.R.S. range from a low of 15 pieces to a high of over 50,000. Parts from ½ pound to over 25 pounds are heated, merely by changing inductor coils and power control settings.

Better Working Conditions—TOCCO makes the forge shop a better place to work by doing away with noise, dust, dirt, smoke and radiant heat and gases produced by old fashioned furnaces.

If you're looking for a way to produce similar results in your plant, it will pay you to consult a TOCCO Engineer.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—**NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept: B-10, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging".

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

Electro-Magnetic Gage Head is Basic Unit of Gaging System

Basic element of new electronic gaging system is a hermetically sealed gage head, known as the Electro-Probe, whose electronic signal maintains an extremely linear relationship to contact movement. This linear output is available over an 0.060-in. contact travel.

First application of the Electro-Probe system is the Model 230P-2 electronic test indicator (illustrated). It includes the gage head and a battery-powered, transistor amplifier, plus accessories. Two ranges are available: 0.004-in. range with 0.0001-in. graduations, and 0.002-in. range with 0.00005-in. graduations. Gaging pressure is uniform throughout range; actual change is less than 0.1 grams per 0.001-in. movement of the clutch-mounted contact. Full-scale zero adjustment permits flexibility in positioning the head.

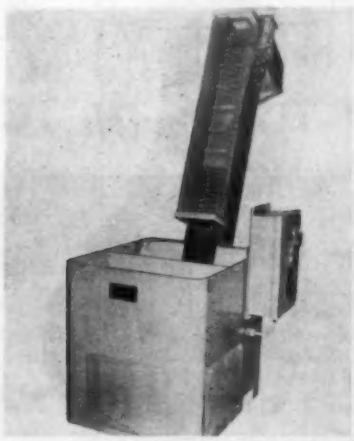
Federal Products Corp, Providence, RI

Air Tools Feature Interchangeable Gears, Spindles, and Chucks

New 12A-2 Series screwdrivers (illustrated) and 16A-2 Series nutsetters have a complete speed and torque range. The newly designed air intake and exhaust increase power, improve motor efficiency and muffle noise. Tools, which have capacities up to 5/16 in., feature interchangeable gears, spindles, and chucks.

Manufacturer states that a choice of straight-drive, positive and cushion clutches, with holders for ¼ and 7/16-in. hex socket drives, and the new Safe-Torque (Scully-Jones and Co) clutch make these tools extremely versatile. Both series of tools are powered by the Keller Tool No. 2 air motor. Bulletins 12-101 and 16-301.

Gardner-Denver Co, Quincy, Ill

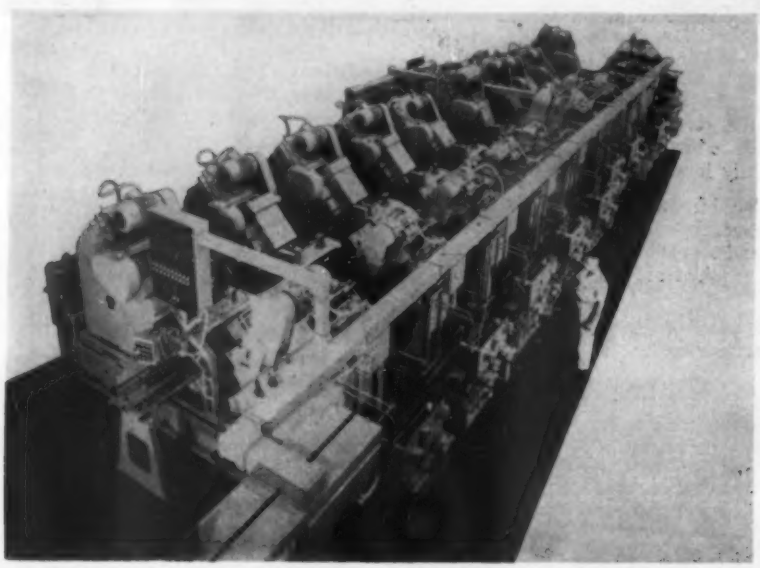


Feedall Adds Automatic Bulk Loader to Feeder Line

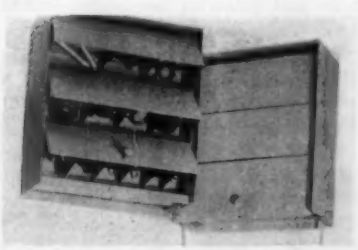
Cycled for automatic loading of a vibratory feeder, the Model 2400 loader is entirely self contained and is powered by ½-hp motor and variable-speed drive with electrical controls. Hopper has capacity of 4 cu ft. Parts are picked up from hopper by metal cleats on the moving conveyor and elevated to the vibratory feeder.

Unit features low loading height, variable elevation angle, and power take-off from conveyor cam, and can be modified to feed rolling or sliding parts in a wide range of sizes.

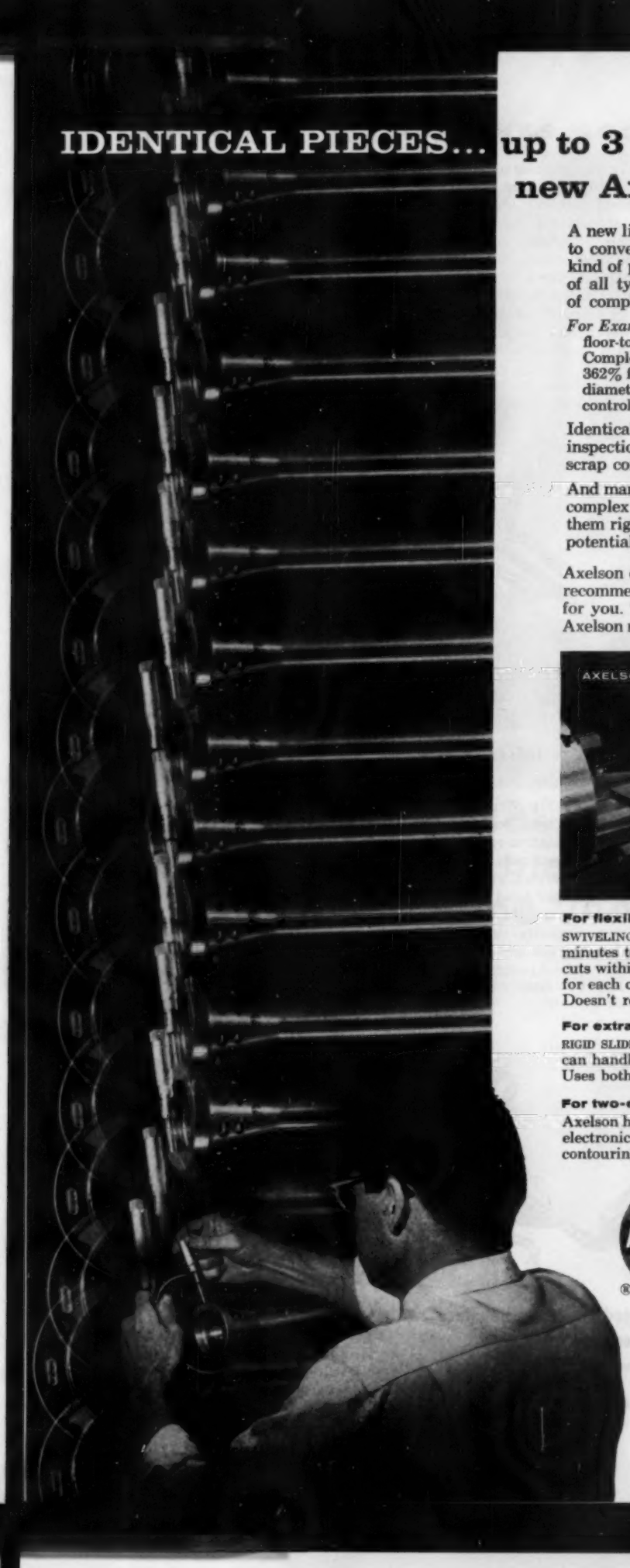
Feedall, Inc, 38399 Pelton Rd, Willoughby, Ohio



V-8 ENGINE BLOCKS are processed on this 10-unit transfer-type machine. As each block passes through the line, the 8 cylinders are rough bored, semi-finished bored and counterbored, and both ends of each cylinder are chamfered. All functions are tied together electrically; control is centralized in one push-button station near the feeder station. Units can be operated individually if necessary—*Moline Tool Co, Moline, Ill*



PORTABLE STORAGE CABINET contains 13 varied-size compartments; louver operation opens all trays at one time. Unit can be placed on workbench or hung from wall. Over-all size is 12 x 13½ x 6 in.—*Arcline Products Co., 1415 W Shakespeare Ave, Chicago 14, Ill*



IDENTICAL PIECES... up to 3 times faster...with new Axelson Tracer Lathes

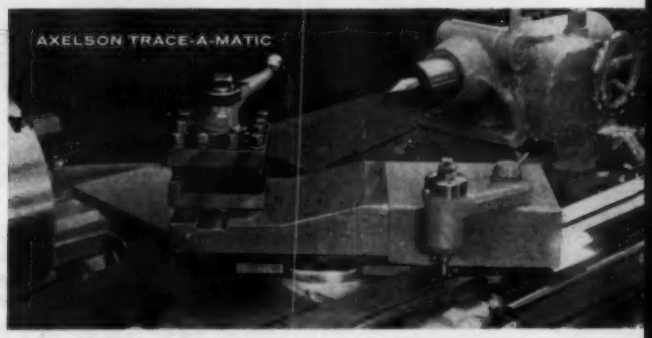
A new line of hydraulic tracing attachments is ready to convert your Axelson engine lathe into a different kind of production tool . . . speed up identical output of all types of work . . . open whole new areas of complex contouring.

For Example: With as few as six forged spindles to turn, floor-to-floor time has been cut in half with a tracer setup. Complex aircraft shock struts have been turned out 362% faster with a simple single-point tool turning diameters, radii, and tapers in one uninterrupted cut, controlled automatically by a template.

Identical pieces . . . free of human error . . . reduce inspection costs and make work scarce for the scrap committee.

And many shops that weren't able to handle especially complex contours have found that tracers take them right in stride – greatly increasing the profit potential of a lathe.

Axelson engineers will analyze your blueprints . . . recommend the tracer use that will be most profitable for you. To get complete information, call your Axelson representative or write for Bulletin MA-10-7503.



For flexibility and extreme accuracy...

SWIVELING SLIDE, COMPOUND-MOUNTED TRACER. Takes only minutes to replace standard compound. Holds finishing cuts within tolerances of ±.001. Swivels to optimum angles for each contour. Doesn't decrease swing over cross-slide. Doesn't reduce tool slide travel.

For extra-heavy cuts...

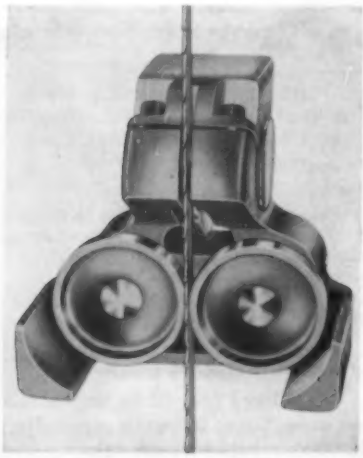
RIGID SLIDE, 45° TRACER. Absorbs maximum cuts machine can handle. Gives operator easy access to work. Uses both flat and round templates.

For two-dimensional tracing...

Axelson has available fully engineered hydraulic and electronic tracing systems to permit two-dimensional contouring, with or without cross-center turning.

AXELSON LATHES

AXELSON MANUFACTURING COMPANY
Division of U. S. Industries, Inc.
6160 South Boyle Avenue, Los Angeles 58, California



Bandsaw Guide Permits Heavier Thrust Loads and Higher Speeds

Bandsaw guide, tradenamed Carter Guidall 400, is said to operate satisfactorily on saws cutting any material at any speed or load. This is reported to be the first guide that has the edge of the blade riding on the outside perimeter of the thrust wheel and with the thrust and support rollers all operating on the inner raceway of the bearing. The model which handles blade speeds up to 15,000 fpm is said to be 166% more efficient in both speed and load than any guide using the outer raceway. It accommodates saw blades from 3/16 to 2½ in. and handles thrust loads of 175 lb at max speeds and 500 lb at lower speeds. For applications requiring a wiping action on the blade the guide can be supplied with support blocks instead of rollers.

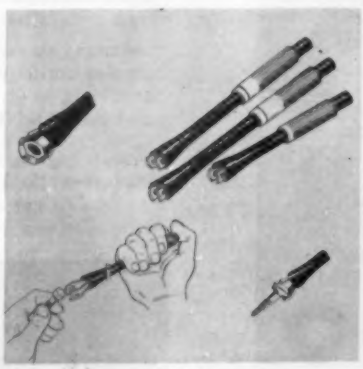
Carter Products Co, Inc, Grand Rapids, Mich

Finger-Type Dial Indicator Will Repeat Within 0.0001

Dial of the "Pearson" is graduated to 0.050; range of the indicator is 0.075. Unit will read either direction with no reversing lever. It can be used for height gage or other gaging work requiring repetitive indications.

Additional features: it will track with no appreciable lag, making it particularly adaptable for aligning holes on a jig borer, boring mill, truing, straightening, and general setting up to within 0.0001 of an inch; extra long contact point; 360° universal swivel joint for positive support in any position convenient to the work.

M & G Instrument Co, 12940 Saticoy St, North Hollywood, Calif



Tool Tightens or Loosens Nuts, Bolts, and Machine Screws

Tool, designated Tip Wrench, eliminates finger fumbling and makes it easy to get into hard-to-reach places to tighten or loosen nuts, bolts, and slotted machine screws. Thumb pressure on the plunger head causes the jaws to open and slide out to the desired size. Capacity ranges from No. 2 to No. 12 nuts and bolts. Tool is completely shockproof.

Tipco Mfg Co, 14758 Calvert, Van Nuys, Calif

Two-Speed Machine Vises Have Increased Gripping Torque

Two new Hylo machine vises, products of Great Britain, incorporate 2-speed closing and gripping traverse with open-jaw capacities up to 12 x 12¼ in. Available in five sizes with capacities ranging from 2 to 12¼ in., all models feature a compact differential feed mechanism that permits a tremendous increase in gripping torque without sacrificing speed of traverse.

Utilizing two threads of different pitch on the same shaft, a single revolution of the handle will open or close the jaws at the rate of ½ in. per rev; low speed traverse rate of 1/10 in. per rev is automatically engaged when jaws contact workpiece. Also available is a double-jaw, double-grip 12 x 12-in.-capacity vise.

Distributed by Redbow Precision Tool Co, 1113 West Lawn Ave, Racine, Wis

Vacuum Furnaces Provide Uniform, Easily Regulated Heating

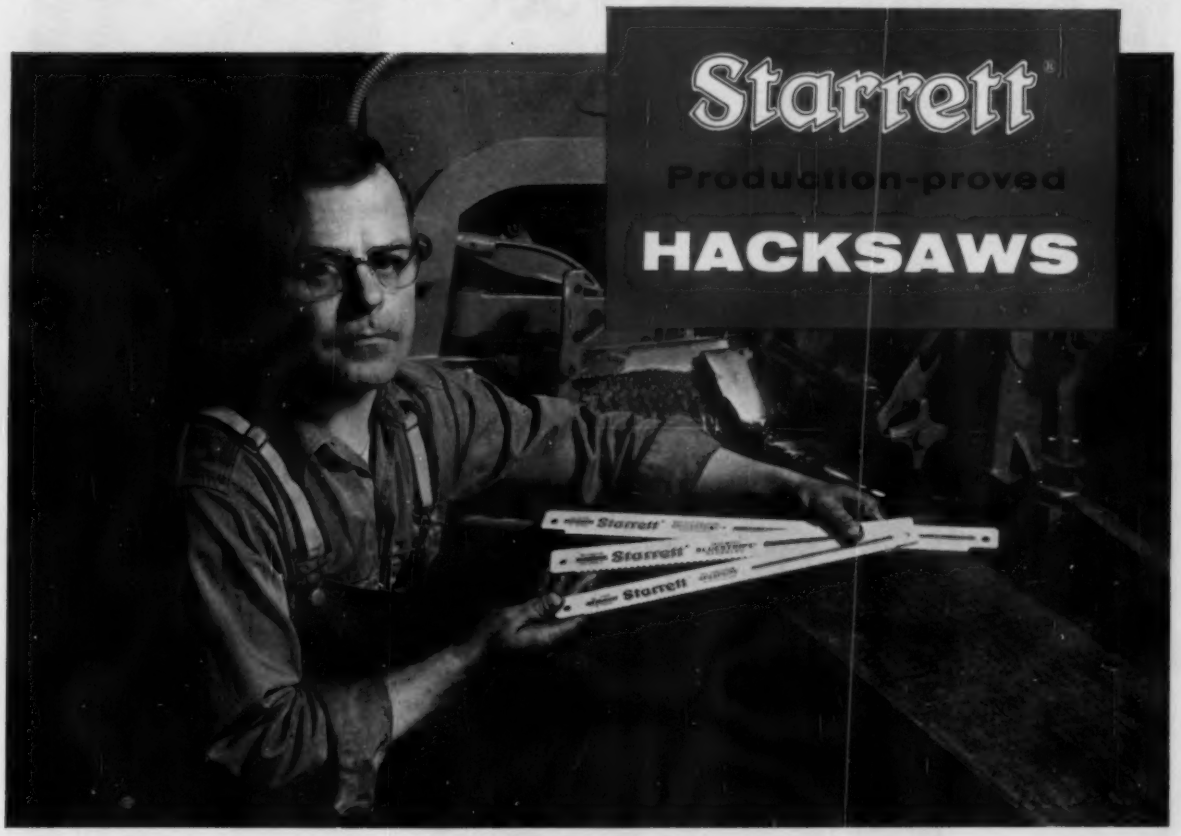
Standard vacuum furnaces are available for either single or double pump vacuums. Double pump, pit or bell-type furnaces are built to operate up to 2100 F. Single pump vacuum retorts for bell, pit, box, or tube-type furnaces are not recommended for temperatures above 1600 F

Electric heating elements and zoned heat control assure safe, easily regulated, uniform heat throughout chamber.

The furnaces can be used for the refinement, heat treatment, and joining of titanium, zirconium, stainless steel and other materials. Mechanical and physical properties of metals can be improved by hardening and annealing, brazing, sintering, degassing or soldering in a vacuum. Bulletin 557 is available on request.

Hevi-Duty Electric Co, 4212 West Highland Blvd, Milwaukee 1, Wis

STARRETT PRECISION MAKES GOOD PRODUCTS BETTER



Named and color identified to help you specify the right blade for low cost, fast cutting, long life

Colorful hacksaw blades with easy-to-remember, colorful names — a plus value that makes Starrett Production-Proved Hacksaw Blades easy to specify and easy for shop men to identify.

Bright yellow blades with the *red stripe* are Starrett REDSTRIPE SM* High Speed Hand and Power Blades . . . extra tough, long-wearing special alloy high speed steel blades recommended for production work and run-of-the-shop jobs.

Yellow blades with the *green stripe* are Starrett GREENSTRIPE SAFE-FLEX* High Speed Hand and Welded Edge Power Hacksaws . . . shatterproof, unbreakable blades — *the safe* blades for heavy feeds, gang sawing and interrupted cuts.

Yellow blades with the *blue stripe* are Starrett BLUESTRIPE* High Speed Hand and Power Hacksaw Blades made of selected high speed steel especially heat treated for high speed production sawing and hard-to-cut metals.

Your nearby Industrial Supply Distributor has these Starrett Hacksaw Blades in a complete range of hand and power sizes. Call him for quality products, dependable service or send for Starrett Hacksaw Catalog which gives complete application data. Address Dept. C, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

*Registered trade names

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PRODUCTION-PROVED HACKSAWS

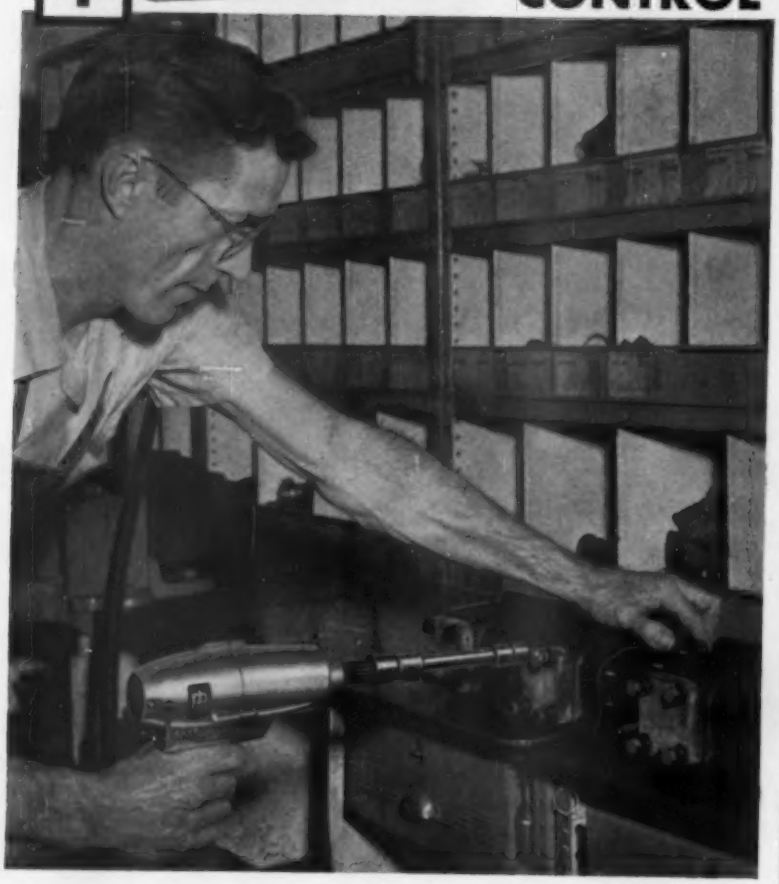
World's Greatest Toolmakers

STARRETT TOOLS

Visit Booth 1730
National Metals Show

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLESAWS • BAND SAWS • BAND KNIVES

TORSION BAR TORQUE CONTROL



TORQUE CONTROL IMPACTOOLS meet torque specifications 100%

Quality Control Improved on 12 Jobs in 3 Departments

1. **Cable control assemblies:** 5 operations involving torques from 14 to 75 ft. lbs.
2. **Scraper Assembly:** 6 line jobs using Impactools set for 40, 60, 75 and 80 ft. lbs. torques.
3. **Hydraulic control assembly:** 1 job running ½" cap screws to 65 ft. lbs. torque.

Production checks made by this manufacturer of road building equipment show that new Ingersoll-Rand Torsion-Bar Torque Control Impactools run every nut and cap screw within torque specifications.

With the standard impact wrenches previously used, the operators attempted to control torque by length of time the tool impacted. The new Torque Control Impactools shut off instantly and automatically when the pre-set torque is reached. This simplifies operator training and improves worker morale.

The end result is dependable product performance in the field. This same kind of cost-saving performance can be put to work for your company now. Write for Bulletin 5170.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-525

Round Table..

REFERENCE CORNER

Would a small technical library be useful in the shop? Would it be abused, or simply not used? Can the men get sufficient information from their own or a foreman's handbooks?

THE NEXT THING you know Al's going to come up with an idea to have a swimming pool in connection with the shop so the boys can go out and float around on their backs on company time. There seems to be a new theory in the wind, "the more you loaf the more you produce," but I'm old-fashioned enough to believe that in doing away with all these frills and getting down to business greater efficiency will result.

About the only question that can come up in the shop (whose purpose is production at the maximum) is something that can be answered by the flip of the page. I am in accord with the foreman having a shelf of textbooks—books of genuine substance such as the *American Machinist* handbook, Moore's "Holes, Contours, and Surfaces," and a few assortments of geometry, trig, and the like. If an argument arises during some noon-hour confab as the boys sit along the bench, let it be settled on their own time—especially if it does not pertain to the work at hand.

Jack Everett
San Francisco, Calif

THIS IS A very important Round Table topic. One need only think of the future leaders of industry and consider that most of the executives in times to come are now working as

"Prentice, I'd consider it a favor if you'd settle your domestic difficulties at home."

craftsmen, helpers, or apprentices to realize how important it is to give them all information that is possible. These guys are at the present found in any machine shop anywhere. To promote their interests and ambition, a small technical library is quite a good thing to have nearby.

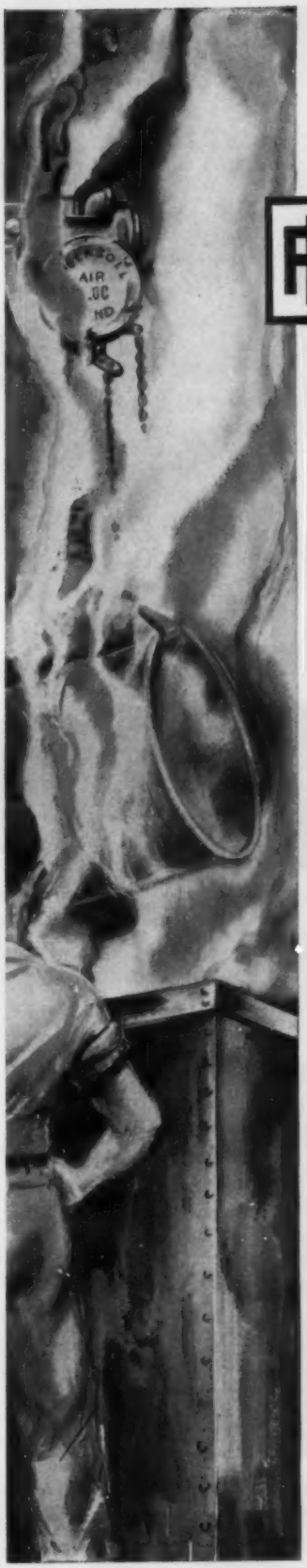
Many young fellows set out early to collect anything that may help them advance in their daily tasks, but they may not be able to buy all the books they need for this purpose. They will, however, eagerly read such books as are available. The nearest public library may be miles away from their place of work or their home, and if they are to go to some community center to borrow the books they need, lots of valuable time is wasted.

In this connection I don't think I say too much if I point out that there are very few suitable technical books on the market for the young fellows who want to work themselves up to real craftsmen, draftsmen, tool designers, or executives. Most technical books are full of mathematical tables and formulas and therefore more suitable for the trained engineer. But this the young guys don't understand, and they get tired of them. What they need and want is more information about their machines and the tools and methods used in manufacturing their particular type of product. And Ed and Al should not overlook the mass of information given in the machine-tool manufacturers' catalogs and the technical magazines published.

There is no need of worrying about whether or not guys should be allowed to use such libraries during working hours. This is not necessary; no loafers need be tolerated. The young men who work to advance themselves are satisfied if the books or magazines they want are available after the work is finished for the day. Information during the day should be given by the foremen.

If, as Ed says, there are plenty of reference books around in their shop and the only thing they have to do is to go and borrow them, then I don't see why this borrowing cannot most suitably be done at the suggested library. Or does Ed mean that anybody can pick up the reference book he needs anywhere if he can find it? If so, I bet nobody will find the book he wants. Borrowing books must be organized in some way or other, otherwise no one will know what has become of them. Only in exceptional cases should a man have to depend on his fellow comrades to use their books if need be. Any in-

(Continued on page 232)



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Ingersoll-Rand Overhead Air Hoists are available in many types and sizes. Capacities range from 200 lbs. to 24,000 lbs. Your I-R AIRengineer can point out how these air hoists can give you new hoisting economy. Call him today, or write direct for catalog data.

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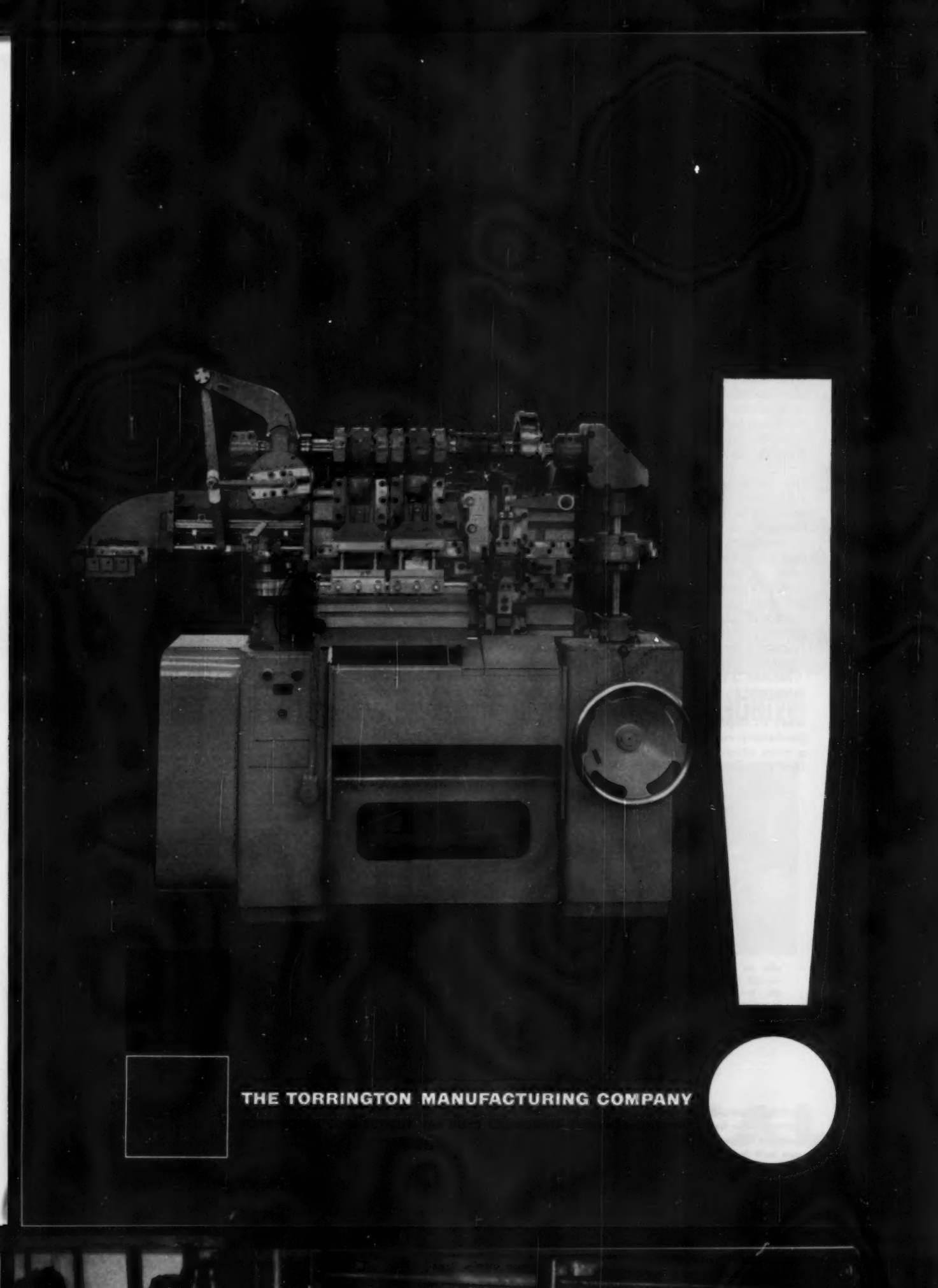

THE TORRINGTON MANUFACTURING COMPANY

vested dollar for technical books will pay itself many times over in a short period of time.

Any company thinking it is wasted money to buy technical books for a library of this kind is ready for reorganization. I agree with Al that if only one man used the library each day it would be worthwile having it.

The youngest office girl could keep track of the books so the guys would not steal them or spoil them.

A E Fristedt
Stockholm-Bromma, Sweden

BRAINSTORMING IN THE SHOP

Will lecture sessions to familiarize the workers with the over-all picture of products made in the shop tend to stimulate improvement in quality of production, or bring out new ideas from the men?

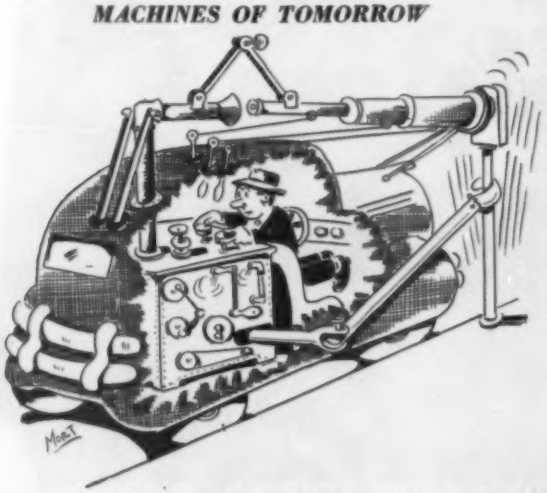
THE ENGINEERING DEPARTMENT is a very important part of a modern plan but in no way does it have a monopoly on brains or ideas. It has so frequently happened in the past that some employee in the shop has come up with a good cost-reducing idea, or an improvement in the product, that suggestion boxes are now placed in most of the progressive plants everywhere and substantial payments are made for good suggestions.

Malone is trying to get his men so interested in the company's product that they will get to thinking of ways to improve the output, reduce production costs, or give the product a more attractive appearance to potential customers. A group of employees sincerely trying to develop a better product at the lowest cost have the best assurance of more permanent jobs and full-time employment, especially in these rather sudden business depressions that, at times, unexpectedly develop in spite of all efforts to prevent them.

There are many records of where a regular employee has developed a much better product and has been taken into partnership or elevated into an important position. There is the case of a line of forming presses, each one doing its part of producing a complicated steel device from a continuous steel ribbon; production around 30 per minute. One of the toolmakers got an idea. He made a pair of special gears, ran the steel ribbon through the forming gears and produced a better product at 150 per minute. The man was taken into the firm and it quickly expanded to have almost full control of the market.

And then there is the story about the Scottish engineer, James Watt —that when he was a boy he was hired to turn the water valve that sprayed the condensing water into the vertical cylinder of a large Newcomen pumping engine and this had to be done for every stroke of the slowly turning engine. A few days later the mine owner saw James playing around away from his job and, afraid that the mine was being flooded, he raced to the pumping room to get the engine going and was astonished to find it running smoothly without anyone there to operate the condensing water valve. James Watt had rigged up a system of levers and ropes so that the water

MACHINES OF TOMORROW



Portable Electronic spectrum for pre-scanning parking meters and recording if mechanism is in working order before dropping in coin. Designed to save car owner coins, time, alibis and cash paid out for undeserved parking tickets. Designed by the Nickelodeon Nickel Co. Ltd. for British cars built for the export trade.

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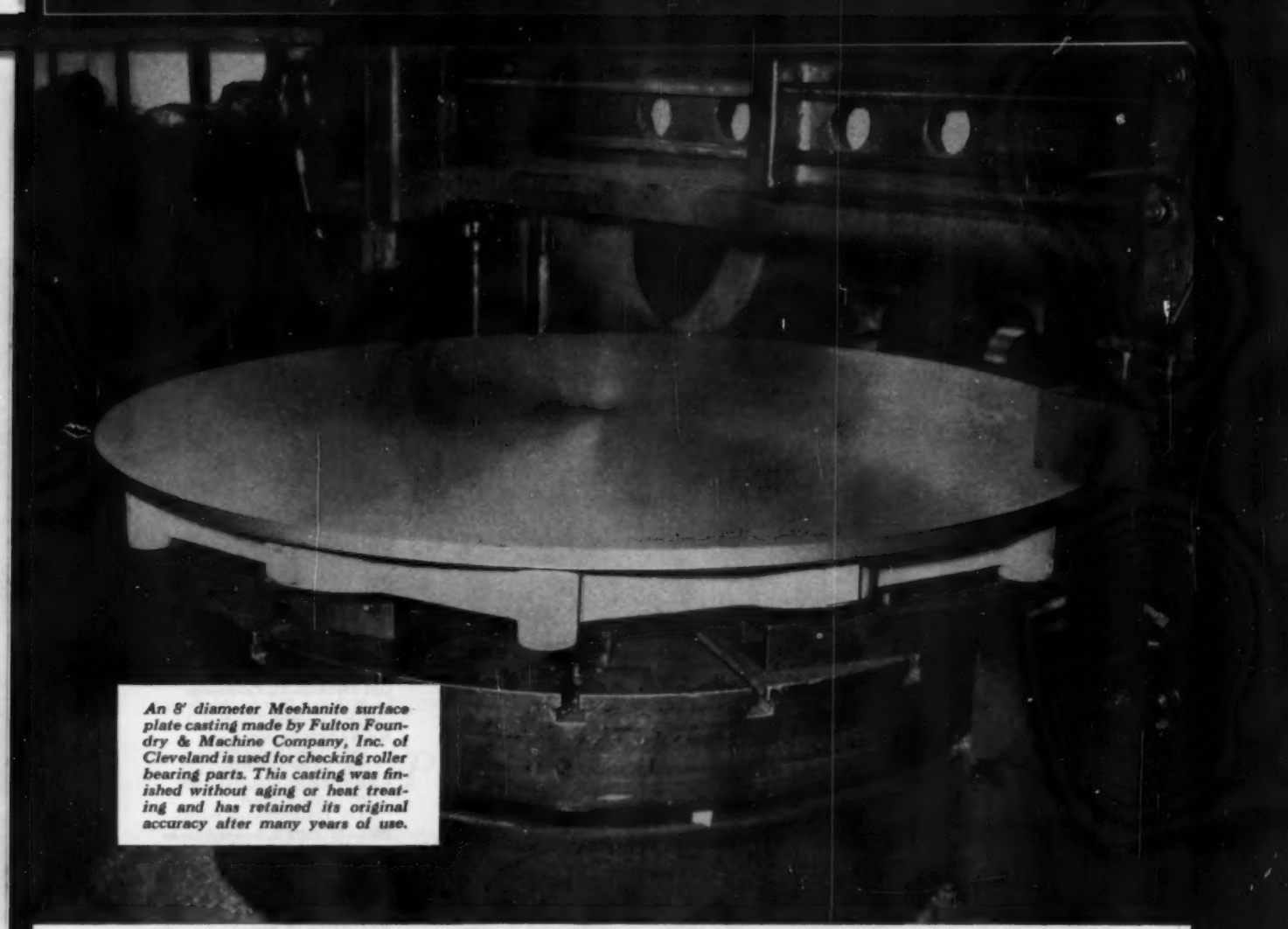


An 8' diameter Meehanite surface plate casting made by Fulton Foundry & Machine Company, Inc. of Cleveland is used for checking roller bearing parts. This casting was finished without aging or heat treating and has retained its original accuracy after many years of use.

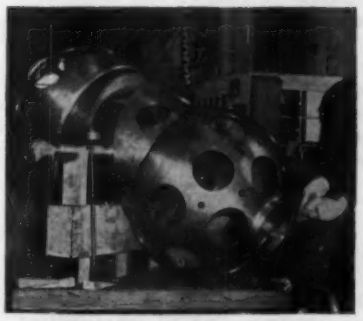
Meehanite castings maintain dimensional stability

Maintenance of accuracy of dimension is of first importance in modern engineering components. Meehanite metal has found wide favor with design engineers because it exhibits an unusually high degree of stability in the "as cast" and also in the hardened condition.

In addition to dimensional stability, the uniform solidity, greater strength, rigidity and shock resistance of Meehanite metal permits advantageous design changes and substantial reductions in casting weight.

Although structurally similar to high grade carbon tool steel, Meehanite metal contains graphite particles in controlled quantity and shape. This assures dense and uniformly solid castings regardless of weight or dimension.

If you have a question concerning the use of Meehanite® in your casting design, consult a Meehanite foundry and write today for your free single copy of "Casting Design As Influenced By Foundry Practice."



Meehanite® was selected in the construction of the Morrison Planetarium Projector because of its ability to maintain dimensional stability. These castings were made by Vulcan Foundry Company of Oakland, California.

MEEHANITE BRIDGES THE GAP BETWEEN CAST IRON AND STEEL®

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK

was automatically turned on and off at the right instant to keep the engine running automatically. This was the invention of the valve gear.

Machine nuts used to be tapped by long shanked taps and the nuts accumulated on the shank until it was full, then the machine was stopped, the tap removed, the nuts slipped off, the tap replaced and a nut blank placed in the socket and tapped, and so on. Then there came a time when a couple of men at the far end of the shop started earning two and three times as much piecework pay as the rest of the gang. The foreman investigated and found that they had abandoned the tapping machines designed by the engineering department, and had taken the long shanked taps and bent the shank into a quarter circle curve, got some castings made with cored holes that also were a quarter circle, and of various sizes, so the nuts would slide thorugh. A casting was mounted on the drillpress table, a socket to loosely fit the nut blank was held in the chuck and away they went dropping a nut blank on the end of the tap, bringing the socket on the nut which quickly spun and tapped it down the tap from where it worked its way down the shank, around the curve, and finally dropped into a tote pan. It was a continuous tapping job and the drillpress never had to be stopped, the tap never had to be stripped and so the nut blanks were being tapped for almost 100% of the time. The two men got a nice cash award for their improvement and it was said that the engineering department fellows had noticeable red faces for almost a month.

Some of the shop men have very good ideas and, with a little encouragement, can plan ways to improve the product at important savings—and Malone is apparently trying to do this very thing.

George P Pearce
Albuquerque, NM

ON THE SIDE of presenting my opinion on how, and to what extent, programs to familiarize employees with products and manufacturing problems are giving or are expected to give results, I will also say a few words about their applicability and systems of disclosure of variable information to all interested from the top of the bottom.

The general and cooperative programs to familiarize employees with the engineering and development aspects of a company's products, as well as with the detailed manufacturing, or even distribution problems, should be established according to size of the enterprise, and local customs.

In the huge, multi-works concerns with rigidly established system of ranks and, alas, almost "obligatory" red tape, two separate systems may be recommended: one mainly reserved for those of higher echelon—supervision, and candidates to this group, and the second reserved for office and shop help. This first category should attend special meetings to discuss and review current programs and, if necessary, to plan initiation of new or revised programs. Sales and service personnel should, in addition, analyze inventory situation and also general market outlook. Minute record and future planning reports should be prepared for the managing body and preparation of resumes for employees.

The second category should be informed about ideas and plans of engineering and manufacturing departments without going into details or secrets of confidential planning. This information should be published in the house organ or displayed on bulletin boards.

On the side of above-mentioned items a special emphasis should be repetitively given to the safety, waste, salvage and suggestion programs. Conveying the information to the above mentioned group during the special meetings and during the working hours probably will not give very good results and will be time-consuming, and naturally will result in much gossip and confusion.

In the moderate-size plants, with so-called personal touch of manager or owner, another more cooperative system may give much better results. Mixed, general meetings of labor or office representatives, or foremen, with the managing group should be periodically arranged and used as mediating, planning, and discussion bodies. In such plants the dividing line between progress, initiative, direct daily production, and finally economy problems can be dealt with. The result should be mailed to the employees or posted on bulletin boards. Here again, as in the large organizations, conveying the information and meeting results directly through oral channels will distort news and fertilize rumors.

In conclusion it must be rigidly observed that all bad news should be soft-pedaled but not distorted. This is a safety precaution so the released material will not benefit competitors or negatively influence buyers and will not weaken em-

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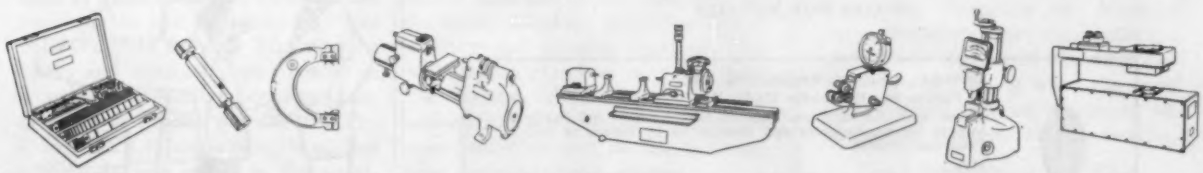

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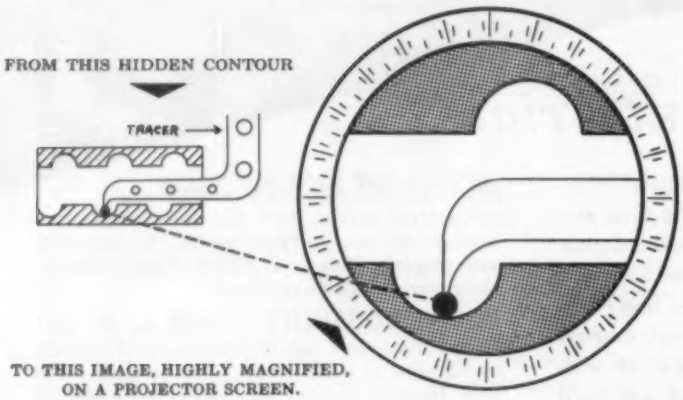

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ployee-morale. Certain complaints about poor workmanship should be even overemphasized to keep workers on their toes. No material should be used as cheap propaganda to squeeze more from labor; such methods will backfire and undermine the friendly and loyal atmosphere.

W S Jero
Dearborn, Mich

BRAINSTORMING for product-improvement ideas should not be an exclusive prerogative of the engineering department. Brainstorming in shop should be encouraged as a means of tapping a fertile field of potentially good ideas that can lead to betterment of product. For this reason, any program that will familiarize employees with the product and its problems and encourage brainstorming or creative thinking along product-improvement lines is worth trying.

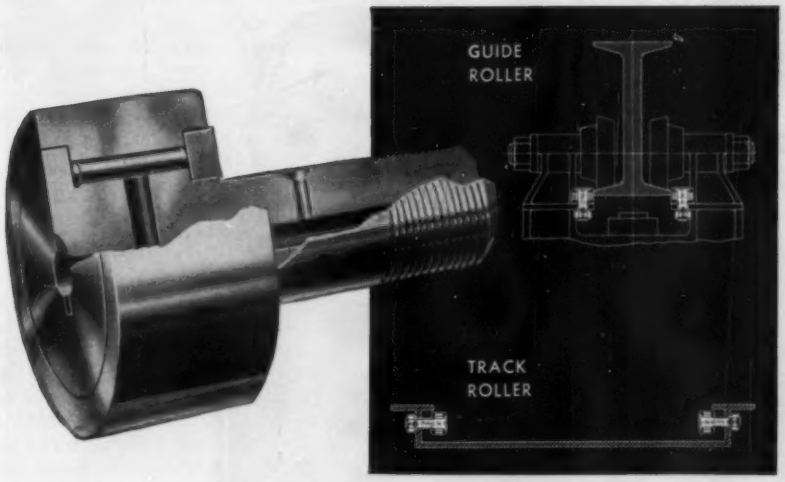
The ability to solve problems related to product improvement is not limited to engineers. Many industries are striving to convince all employees that their ingenuity and ideas are needed and that it isn't necessary that they have engineering degrees in order to come up with pointers on better production techniques and design of product.

One illustration of this has been the revamping of suggestion-box systems. The new systems have been a particular boon for workers not adept at expressing themselves in writing or in conveying their ideas in technical terms. When one of them has an idea, he merely puts his name on the suggestion form. An investigator comes to see him, and listens. The value of this system of making it easy for shop workers to help im-

"I don't care if you are the division chief, if you want a personal job done you have to get on my list!"

BEARING TIPS by McGill

Let a CAMROL® bearing be your guide



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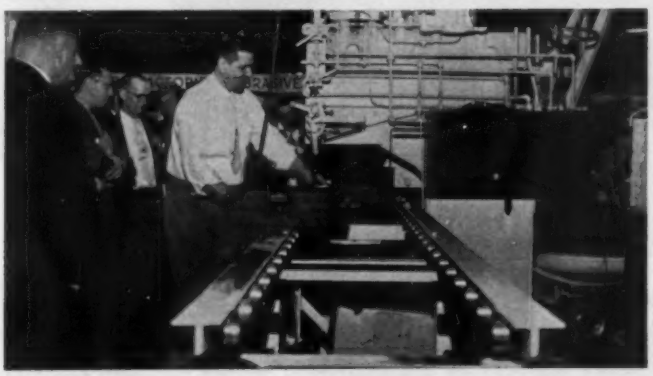
In guide and support roller applications CAMROL Cam Followers insure free rolling action and positive side thrust while eliminating the wear of more costly flanged wheels. Then, too, they provide improved alignment and low starting and running friction with high unit load and shock capacity, especially at low speeds as track rollers. Lubrication is simplified and maintenance can be reduced to a minimum in these applications. Specify the interchangeable sealed SCF series for added protection against contamination.

CAMROL® CF bearings provide friction-free track rollers for automatic mold blower



McGill CAMROL CF rollers are used as guide rollers to form a mold conveyor in the Beardsley & Piper MBS-20 Mold Blower. The machine blows and squeezes cope or drag in a single automatic operation, handling up to 4 molds per minute. The CAMROL CF bearings replaced less efficient friction rollers in this application. Although, the duty here is rather light and speeds slow, the cam follower bearing provides lesser starting and running friction. This helps speed the flow of work from the machine, which must be fast and automatic. The integral stud feature eases assembly and its standard design simplifies procurement.

CF bearings minimize maintenance as crane side guide rollers

McGill CF cam follower bearings serve as side guide rollers in overhead cranes manufactured by Louden Machinery Company of Fairfield, Iowa. Freedom from maintenance, a time saver because of the inaccessibility of the bearing when the crane is in operation, is an important advantage of the cam follower bearing.

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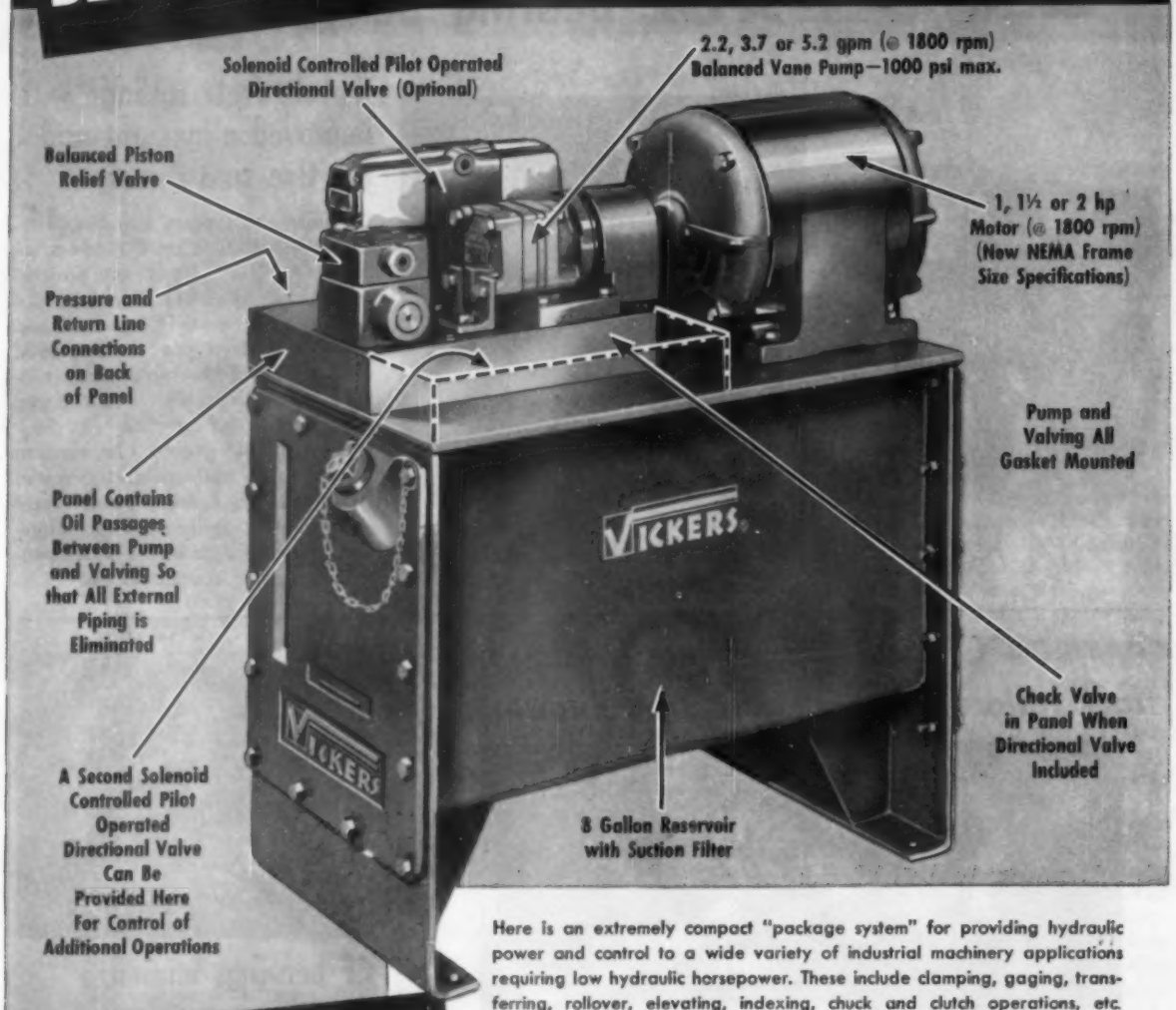
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Here is an extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

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*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

prove production technique and product design can best be shown in the actual case of a company whose engineers had been struggling for months to develop a special forged brake. A forge shop worker, who had never completed grade school, watched their activities from the forge shop, where he had worked for many years. Then one day he scrawled a message on a suggestion form: he knew how to make the forging. The engineers went to the forge shop—and, sure enough, the forge shop worker had the idea that led to the successful solution of the problem.

Any method that will encourage and stimulate workers to think creatively is good business. Whether it be by means of suggestion systems, brainstorming sessions, or programs to familiarize employees with the product and its problems, it's worth the time and trouble to use these think-stimulants. The fact that a man may never have demonstrated any creative ability does not eliminate him from industry's talent-hunts via brainstorming sessions in the shop and elsewhere in the company. Encouraging men to think about the product they are making and how to make it better can best be illustrated in the advice one company gives it workers: "Let your imagination soar—and then engineer it down to earth."

A program to educate shop workers on the company's product and its problems offers them a necessary "think-break" that will certainly stir interest in the product and develop beneficial ideas for its betterment.

Harry Kaufman
Philadelphia, Penna

WHEN I read Ed's introduction to this story I asked myself, what has happened to him? Does he really mean what he is saying? Doesn't he know that two brains can think better than one? If he doesn't know that, he should be one of the pupils in Malone's classroom. Certainly any educational program conducted by competent instructors will leave some ideas in the brains of those participating. Leaving the thinking exclusively to the engineering department is the same as wasting a whole lot of initiative, know-how and interest in many jobs. I don't believe that any engineering department knows everything about any production.

I agree with Al that Ed is wet when he talks the way he does. It is good initiative to stir up interest

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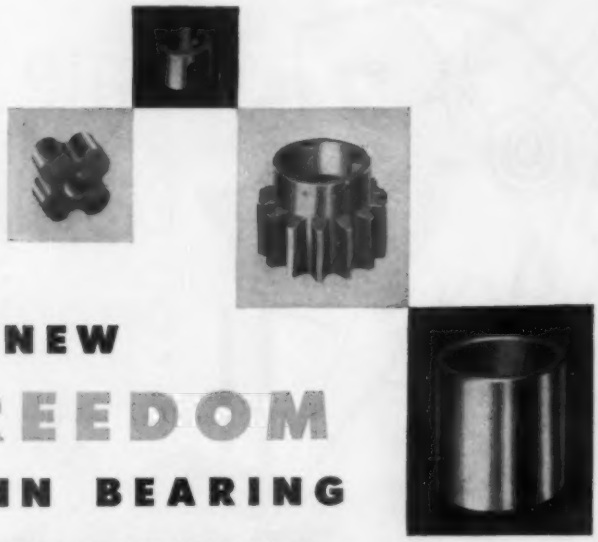

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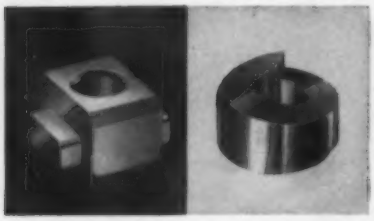

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in any product. That will bring many new ideas within reach, and quality of the product as well as quantity may rise. Anybody, even a guy least expected to possess any ideas, may turn up and solve a difficult problem. So Ed should leave the door open for everybody to take part in improving the product for his employer.

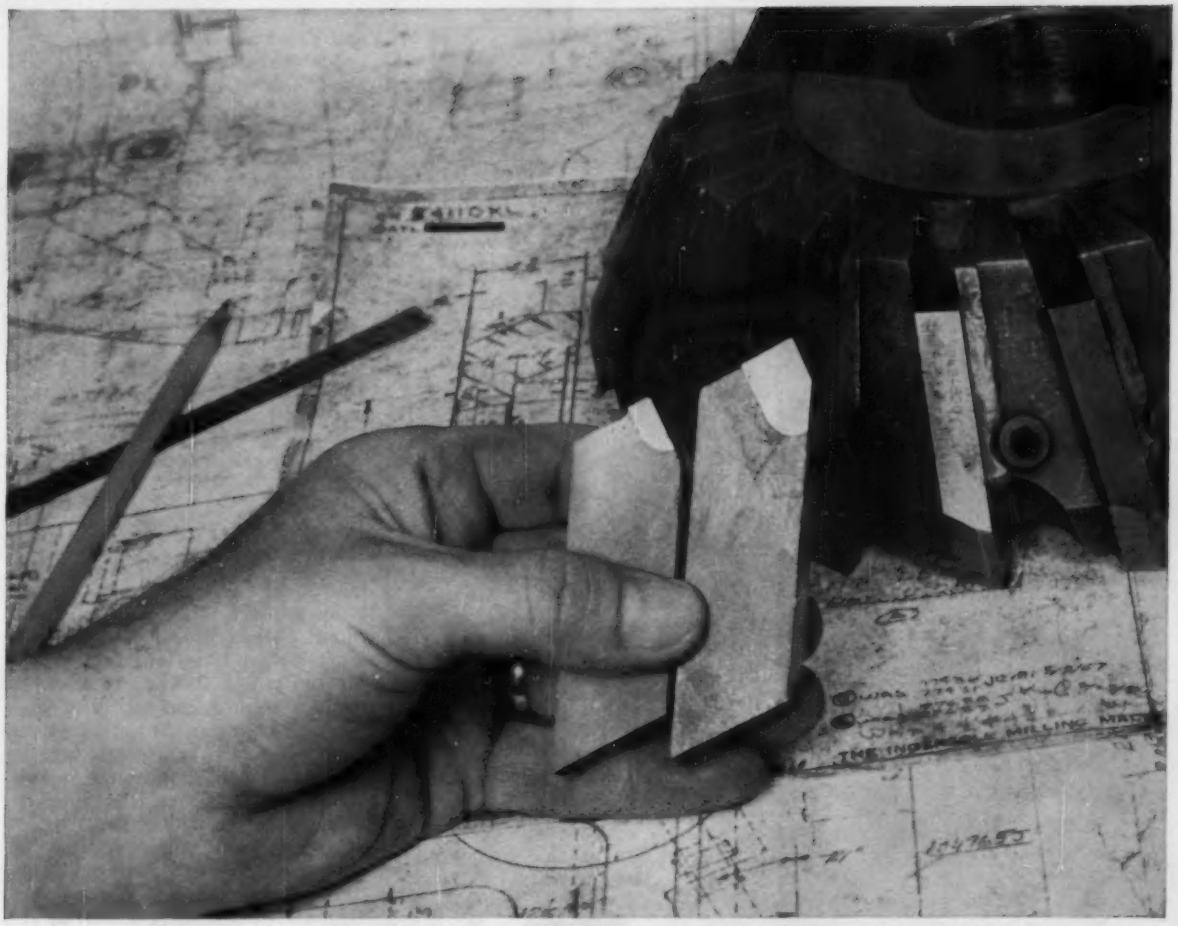
Ed puts a very low value on the guys in Malone's department when he says they are not experienced in design and methods engineering, and that it is a waste of time and money to educate them. He is wrong. If he looks around in his own shop or anywhere, he will always find some men that are above the average and one or two far above the common employee, and even if there are only a few in Malone's department who are really interested in his educational program it is worth while.

Yes Al, if he can pass along only a few better production techniques to or from engineering, an instruction course of this kind will pay for itself many times over. And, of course, it is more efficient to give instruction when the men in a whole department are listening. If this is not done the instructions must be given individually, and repeated perhaps 30 to 40 times, which really is wasted time and money.

Evidently Ed is joking when he says that somebody might figure out a way to eliminate the product entirely. If Malone's intention with his class is to point out the better equipment he should have but cannot get, he might not gain much, but if the inspection of his product is not so good he has an excellent opportunity to point this out in the class room. If his workers are not the best he also has the opportunity to improve their knowledge and raise their ability to think.

Instructions of this kind are excellent means to improve the product

-AU-



Ingersoll Cone-Type Face Mill for general purpose milling . . . designed for low replacement blade cost.

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Most of the carbide in the worn blade was used, but this in itself does not mean that it was used effectively. Many factors are involved in developing the lowest milling cutter cost consistent with improved finishes, faster feed rates and longer tool life.

A continuous review of these factors is part of the day-to-day responsibility of your Ingersoll cutter salesman and of the staff of milling experts he represents. This part of our product has proved its value to hundreds of concerns.

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If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #66K.

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Here's what is meant by "1·2·3" in the GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE

The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a work piece simultaneously or in sequence, without changing set-up or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

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MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

and expel any doubt of how to go about things. If a man is uncertain about how to attack his job he loses a lot of time. Mass-thinking is a strong force which should not be ignored or neglected but directed toward improving the product or its production methods and tools. Why not initiate this in the classroom?

There are many difficult problems solved every day in any shop by men of average ability, problems they have been unable to lick upstairs.

It would be easy enough to point out many such cases. Combining engineering knowledge and practical know-how always give best result.

A E Fristedt
Stockholm-Bromma, Sweden

IF I AM HIRED out as a toolmaker or machinist I am hired to do certain kinds of work. The job to me is the thing; I don't give a tinker's dam what the job is as long as I get my take-home. All I want to know is what is wanted and I'll do it come hell or high water. Where the part is to be used is no concern of mine so long as I turn out the piece to conform to certain limits determined by the engineering department.

Al, if you're going to wise up everyone on what's going on you'll have every Tom, Clarence, and Percival striving to be president of the outfit. You've got to leave a few to be contented with doing the work. If a worker is furnished with a drawing of what's required, and has had the experience to know how to do it, that's all he is called upon to do.

The first thing you know, Al, you'll have all the good workers so frustrated they won't know what in

"Let's take a break."

N. J. Cornwall, Ass't Gen. Manager, Tanks, Inc., manufacturers of galvanized water softener tanks.

This man saves money making water softener tanks with Sciaky Resistance Welding Techniques

Among wives, Norm Cornwall would be rated a wife saver, but at Tanks, Inc., he's a money saver because his production is smooth and almost completely trouble-free. And his manufacturing costs are so low that customers such as SERV i SOFT can offer their water softener rental service at really competitive prices!

Why don't *you* get the facts on how Sciaky resistance welding techniques can simplify your metal parts assembly and lower your unit costs at the same time . . . just as Mr. Cornwall did!

SCIAKY

You can read the details of this application on the next page . . .

Resistance Welding Galvanized Steel

SCIAKY

HELPS PUT PROFIT INTO MANUFACTURING

The Economy of Seam Welding Galvanized Tanks in Limited Production

Questions frequently arise as to the practicality of resistance welding galvanized steel. However, Sciaky Resistance Welding Techniques have proved it can be done safely and economically.

The effect on zinc coating

In spot or projection welding the zinc coating remains intact when the correct Sciaky techniques are employed. In seam or flash-butt welding the zinc on the outer surfaces is removed. However, the corrosion resistance is easily restored by coating the surfaces with a priming paint such as aluminum in the way Tanks, Inc., does it. The efficiency of the Sciaky resistance welding process more than offsets the extra painting operation.

Seam welding galvanized tanks

In the Franklin Park, Illinois, plant of Tanks, Inc., Ass't Gen. Manager, Norm Cornwall, has developed a simple but efficient process for joining bottoms to shells in the manufacture of galvanized tanks.

A single operator, employing Sciaky resistance welding techniques, inserts the bottom in the shell, welds it, and restores the protective coating at a rate of 55 per hour.

The manufacturing sequence

Figure 1 shows the first operation in which the operator drives the bottom into the shell with a hammer. In actual practice he performs this operation and the third operation while welding is in progress.

FIG. 1 Operator inserting tank bottom into the shell.

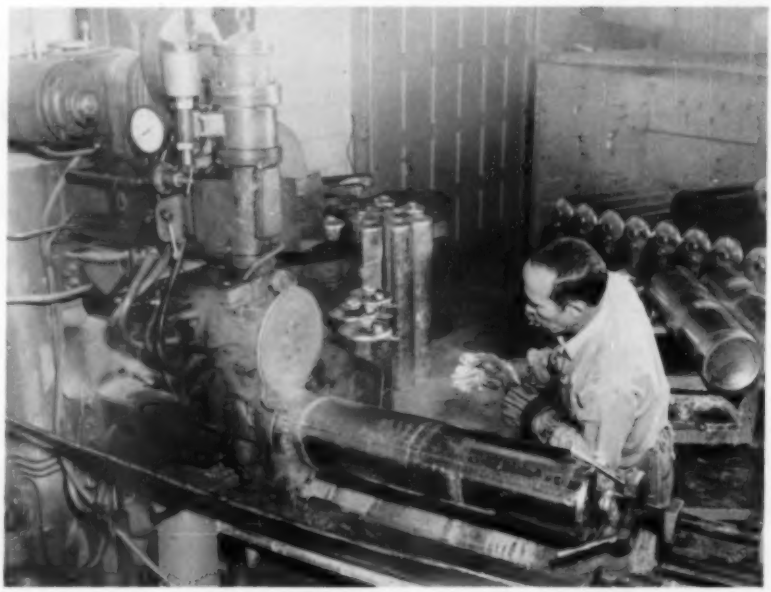

FIG. 2 Sciaky Seam Welder joins the bottom to the shell.

The second operation is the welding. The operator first makes a short (1") tack seam weld on the side of the shell opposite the longitudinal seam of the tank.

The tack welded assembly is then placed in the Sciaky welder and clamped in position by an air actuated fixture. The weld is started adjacent to the longitudinal seam of the shell and the operator helps it over this enlarged section. After this the welding proceeds unattended at a speed of 37.5" per minute with a spot spacing of 15 per inch. (See Figure 2). After completion of the full 360°, the operator allows the welder to continue and reweld over the longitudinal seam. This practice minimizes the danger of "leakers".

In the third operation the operator paints over the seam weld with aluminum paint to restore the corrosion resistance of the seam.

Information available

Case histories outlining the successful use of Sciaky Resistance Welding Techniques on galvanized material are available on request. An engineering report on resistance welding of galvanized steel is also available. Specific recommendations will be furnished on receipt of an outline of your requirements.

Write today, mentioning the information you would like to receive. There is no obligation. Sciaky Bros., Inc., 4932 W. 67th St., Chicago 38, Ill. POrtsmouth 7-5600.

DO YOU HAVE A RESEARCH PROBLEM?

Facilities of the Sciaky Research Division at Los Angeles, California, are available for contract research to answer resistance welding problems. Housed in a 15,000 sq. ft. building, these facilities include an experienced engineering staff, a complete range of the most advanced resistance welding machines including the largest in the world and a laboratory equipped for metallography, chemistry, electronics, photography and testing as applied to resistance welding. Write for further information and ask for the 20 page Research Division brochure.

hell it's all about. Let 'em alone. If they want to know all about the equipment the firm is producing let them inquire and they will be enlightened in time, but this thing of knocking off an hour a week just to satisfy the whims of a super-brain is playing into the hands of the time-killer and at the same time taking the employer for a ride. If a man is so hepped up to get somewhere in the firm he won't object to putting forth some extra effort on his own time.

Rex Warren
Waterloo, Iowa

IF A MAN can produce physically he can also be influenced mentally. They say experience is the best teacher, but this is not necessarily so unless the employee is working toward something. All employees like to be informed. They also like to share and be a part of things. Given the why, the need, they usually show appreciation for the whole objective.

An educational training program is a good teacher. It is a very good way to put direction in the employees' efforts. Many employees have ideas; the educational program will often put spark in the ideas to energize them. These programs get facts, clarify problems, and influence by recognizing. An educational program shows appreciation for human values that inspires cooperation.

Attitudes are not changed by a cold blueprint or merely stating facts and letting the employee apply them. When the employee is allowed to share in facts he is more likely to do a more skilful and careful job. Encourage employees to make suggestions for increasing production and improving quality. This attitude will increase morale and efficiency.

A E Salmons
Norristown, Penna

AN EMPLOYEE should, by all means, be acquainted with the product turned out by his employer. If a man knows the details of the product and the relationship between the various parts making up the whole he's in a position to see where improvements can be made. He may not be a designer, as such, but he has common sense, and common sense surpasses by far the ability to calculate the stress in something of no concern to what is being made at the plant.

I happened to be one of 50 tool makers in an office-machine manu-

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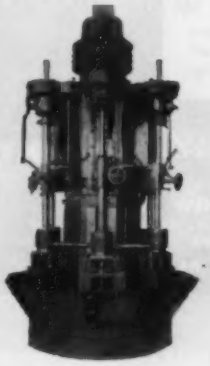
Best in the long run
Practical in the short run

NEW BAKER SPECIAL

bores diesel engine cylinder blocks - automatically

The latest of a long line of Baker special machine tools . . . operations are rough and finish bore and counterbore 6 to 16 holes for cylinder sleeves; drill dowel pin holes.

Compare with the early Baker special "Rotary" below — the *man* walked around the *machine!*



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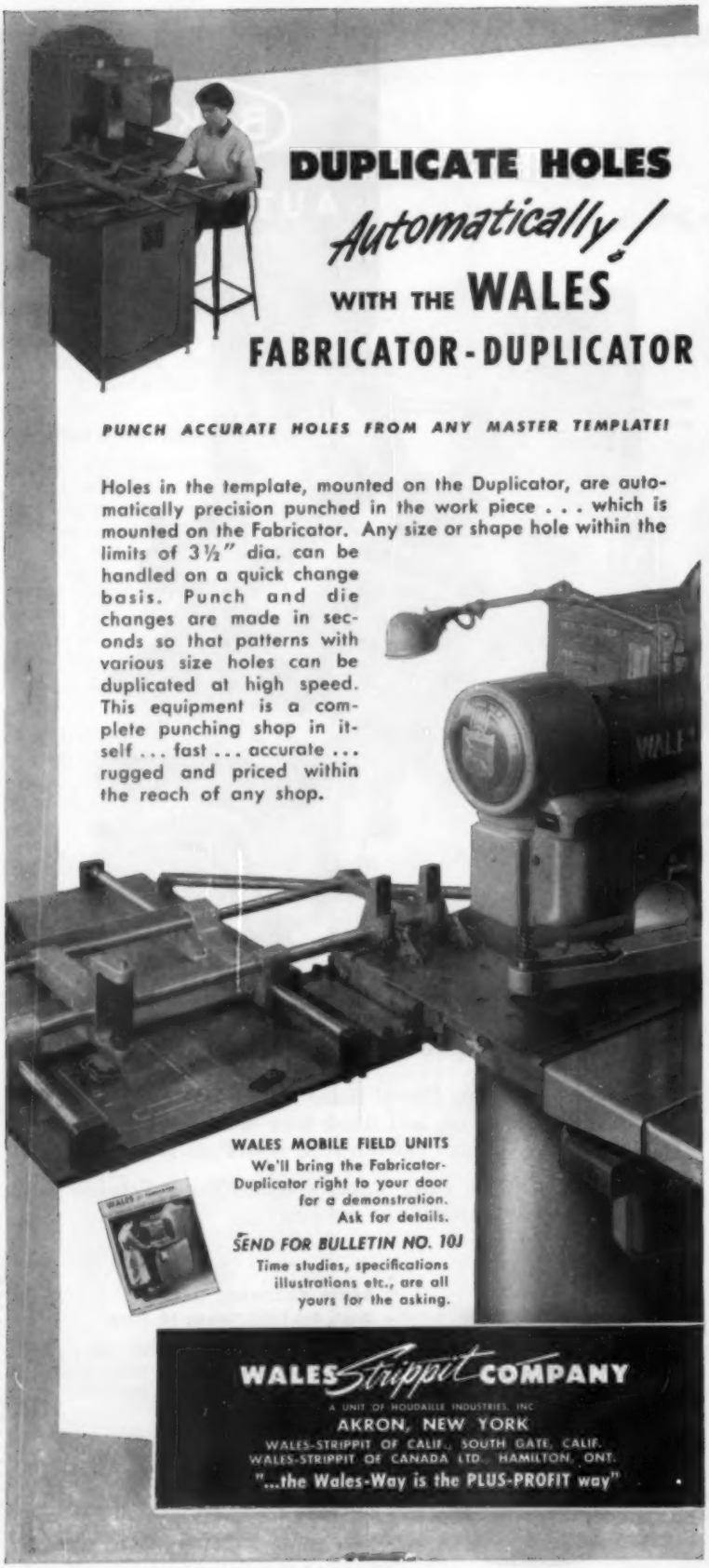
DUPLICATE HOLES
Automatically!
WITH THE WALES
FABRICATOR-DUPLICATOR
PUNCH ACCURATE HOLES FROM ANY MASTER TEMPLATE!
Holes in the template, mounted on the Duplicator, are automatically precision punched in the work piece . . . which is mounted on the Fabricator. Any size or shape hole within the limits of 3½" dia. can be handled on a quick change basis. Punch and die changes are made in seconds so that patterns with various size holes can be duplicated at high speed. This equipment is a complete punching shop in itself . . . fast . . . accurate . . . rugged and priced within the reach of any shop.
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"...the Wales-Way is the PLUS-PROFIT way"

facturing plant in my rock and rolling days and very few, if any, were acquainted with the machine's guts. The result was that there was a decided lack of interest other than the particular job they were working on at the time. The head of the engineering department conceived of an idea to create an interest in the various machines. He first suggested that classes be held once a week, half of the time to be furnished by the company. Most of the fellows found exception to this is they considered that it was entirely an arrangement whereby the company would be the only one to benefit. Rather than defeat his whole idea he prevailed on the company to dig down and the course was started.

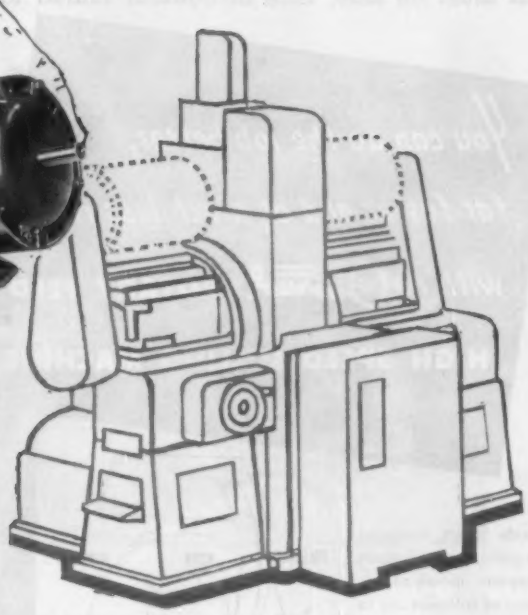
Each machine was thoroughly explained and, with appropriate drawings, was taken up in detail until each mechanism was thoroughly understood. What at first was laughed at as being a crackpot idea finally turned out to be an incentive to improve the product, and imbued the employees with an enthusiastic desire to progress in the plant. A great many valuable suggestions were made which brought down the cost of production and, believe it or not, several of the toolmakers brought forth ideas in design superior to those instituted by the engineering department.

Just because a man wears an apron over his creased trousers, and soils it occasionally, is no reason to think that he hasn't a good head on his shoulders. There are wizards who are in their glory tinkering around with machinery and look with disdain upon the man who bends over the board and plays tiddly-winks with a slide rule. And conversely, there are too many so-called engineers who should be keeping stock in some chain store.

A worker's life is monotonous enough as it is—day in and day out

"I've learned why production is off. Our employees spend all their time writing suggestions."

Put HOWELL in Your Product Picture



...and gain the PLUS values in power that count!

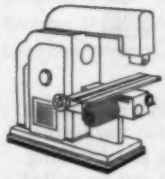
Whatever your requirements for driving metal working machines may be . . . more horsepower in less space, ruggedness for constant start-and-stop operation or the need for streamlining multi-motored, automated equipment . . . you can gain from Howell's 42 years of experience in serving the machine tool industry. Machine designers and plant engineers throughout the industry take advantage of Howell's more than 20,000 motor designs. Here are some of their reasons:

Steel Feet and Frames Won't Crack Under Stress Unlike cast iron, Howell's steel feet won't crack when mounting bolts are tightened excessively. Howell's cold-rolled steel frames can take installation punishment. Cast iron end-plates assure constant shaft and bearing alignment.

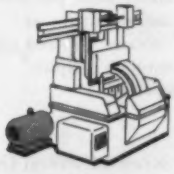
Cool-Running, Long-Lasting Efficiency New stator design with wide slots provides 50% more contact between cooling air and stator laminations. Combined with heat-dissipating copper rotors, this gives you a motor with extra stamina to withstand intermittent overloading or unusually high operating temperatures.

Functional Streamlining Howell motors have no fins, ribs or unnecessary offsets to collect dust deposits. External dirt cannot reduce these motors' cool-running efficiency — their neat appearance is easier to maintain.

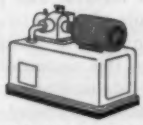
Wide Selection Howell builds virtually all types of industrial AC motors — in sizes up to 300 hp, in all standard enclosures, both rerated and non-rerated; also disc motors and brake motors. For other than standard motor speeds, investigate Howell's complete line of gearmotors — parallel shaft, right angle and the new Line-O Drive series.



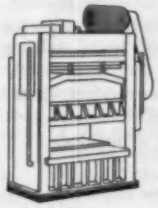
MILLING MACHINES



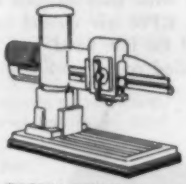
LATHES



HYDRAULIC SYSTEMS



PUNCH PRESSES



RADIAL DRILLS

Among leading machine tool manufacturers who use Howell motors are these:

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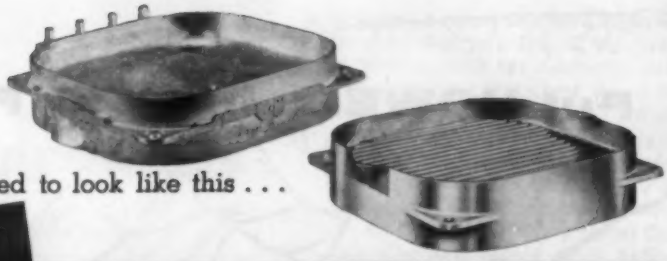
A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL Red Band MOTORS

HOWELL *motors*

. . . precision built for industry since 1915

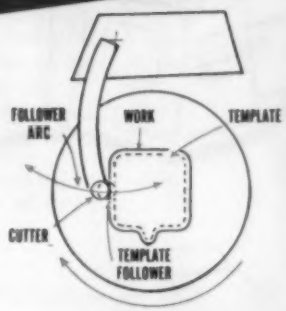
when you have parts of aluminum or other nonferrous metals . . .



that must be side, face or contour milled to look like this . . .

You can do the job better, far faster and at much less cost with an Onsrud **ROTARY FEED HIGH SPEED MILLING MACHINE**

WORK SET-UPS LIKE THESE . . . PART OF THE PRODUCTION



Guide roller mounted on pivoted arm follows template, moves to any point of follower arc to vary cutter head position as required, as table rotates to feed work through complete milling cycle.

Here is one of several Onsrud Rotary Feed Milling Machine models . . . a design type that has become the most versatile and productive in metal milling. The kinds of production parts that can be milled to advantage are almost endless in number . . . wherever the operation involves straight line or contour side milling or horizontal top-edge milling. The A-50AE machine shown here has a capacity for work up to 40" diameter. A high speed milling head with Onsrud two speed 7½/3¾ HP, 3600/1800 RPM air cooled motor gives proper cutter speed for fine finish and rapid feed. Other models supplied to fit work requirements as needed.

ADVANTAGES OF ONSRUD ROTARY FEED MILLING

ALL FOUR SIDES IN ONE SET-UP

Work held by pneumatic center clamp, for milling completely around the part if desired.

CONTINUOUS PRODUCTION

Work fixture built with two, three or four (or more) stations for continuous feed of work to cutter. Operator merely loads and unloads without production time loss.

Write for Information

Let us tell you how Onsrud Rotary Feed Milling Machines can lower your production costs . . . in aluminum and related nonferrous milling. We'll also be glad to give you information on all other Onsrud milling machines for every type of production milling. Your inquiry is cordially invited.

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7712 LEHIGH AVENUE (SUBURB OF CHICAGO) NILES 31, ILLINOIS

Onsrud. High Speed MILLING MACHINES for Aluminum and Related Nonferrous Metal Milling

For doing things *better* by doing things *differently!*

—so why not make it interesting enough to have him really enjoy creating something. If a man is working on a drill jig, fixture, or die to produce some part, isn't it better that he knows the functions of that part in relation to the whole? Ed's claim that the workers aren't experienced in design or engineering methods leads me to the conclusion that age is creeping up on him. Could it be that Ed is becoming waterlogged with industrial ennui and needs a long vacation from his job? I think he is sick and tired of the whole thing himself. Better take up the game of pasture pool, old timer—you old 2-6-2; you're heading for the torch!

There are a few who enjoy an instructional session as a loafing excuse but you'll find that most of the employees are eager beavers desiring to better their lot in life by adding some color—in this case the color is the know-how in what is going on.

J Homewood
Laguna Beach, Calif

PROGRAMS to familiarize employees with the product and its problems certainly have results. Whether the results be positive or negative depends on many factors such as the existing demand for the programs and the ability of the promotors to get the central idea across. If the personnel to be worked on are indifferent to innovation in general and largely composed of operators content to get through their shift with a minimum of thinking, the results are not likely to be encouraging. One, here and there, might make the grade and show a profit on the transaction, but it seems a pity to keep a whole section off production work for an hour in order to encourage one or two potential Edisons in original thinking.

We are not told how often this indiscretion is repeated. My feeling is, the oftener it happens, the greater the indiscretion. Al says "Even if Malone only gets a couple of good ideas, it's worthwhile." Al's idea of a worthwhile return is nothing if not modest. On that showing, the game wouldn't be worth the candle. To my mind, educating all the men on all the company products is on a par with a punter in the football pools making all the possible forecasts of results for, say, eight games played from a list of about fifty. One forecast would be the correct result but the labor and cost involved would be prohibitive. I share Ed's belief that the classroom technical

Built into your equipment

BIJUR

AUTOMATIC LUBRICATION ASSURES SATISFACTION

you benefit 5 ways

- Increase Production Capacity
- Save on Repair Bills
- Eliminate Costly Hand Oiling
- Reduce Downtime
- Lengthen Machine Life

WITH Bijur Automatic Lubrication as an integral part of your machines, you benefit from continuous peak production. Plant after plant reports increased out-put and greatly reduced maintenance costs with Bijur-equipped machines. Costly downtime for lubricating by hand is eliminated. Every bearing is metered the proper quantity of oil at predetermined intervals. Work spoilage and bearing troubles caused by over-lubrication are avoided. Fire hazards are reduced. Personnel accidents are prevented.

More than a million Bijur-protected machines are currently in use. Hundreds of leading manufacturers standardize on Bijur as "built-in" components of their machines. Bijur emphasizes custom engineering, and will gladly cooperate with your machine builder in designing a lubricating system to meet the specific requirements of the machines you order.

Bijur designed into your machines now automatically assures satisfaction. It makes sense . . . and dollars, too! Why not write today for literature and engineering information?

P-2

1443

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LUBRICATING CORPORATION
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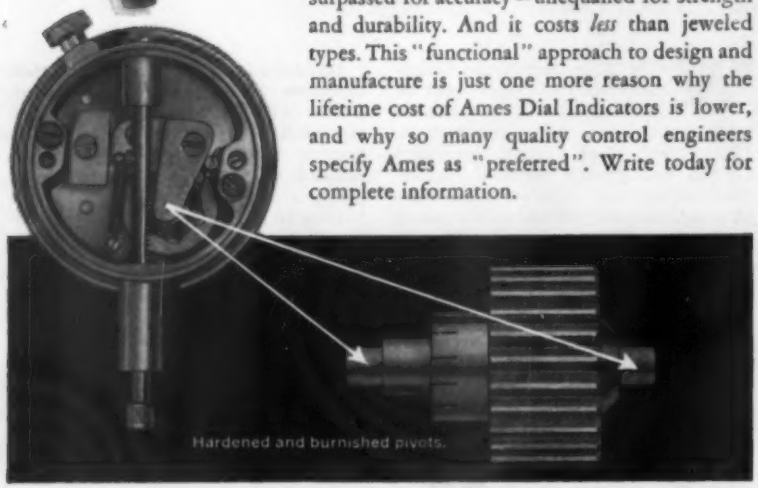
Pioneers in Automatic Lubrication

AMES

...the preferred Dial Indicators...

have hardened and burnished pivots for higher sensitivity – lower friction

Because metal pivots are stronger than jeweled pivots, Ames has developed a method for hardening and burnishing them to match the exceptional smoothness and sensitivity of jeweled types. The result is a dial indicator that is unsurpassed for accuracy – unequalled for strength and durability. And it costs *less* than jeweled types. This "functional" approach to design and manufacture is just one more reason why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as "preferred". Write today for complete information.



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stuff imparted to a section of non-technical operators is likely to yield poor results.

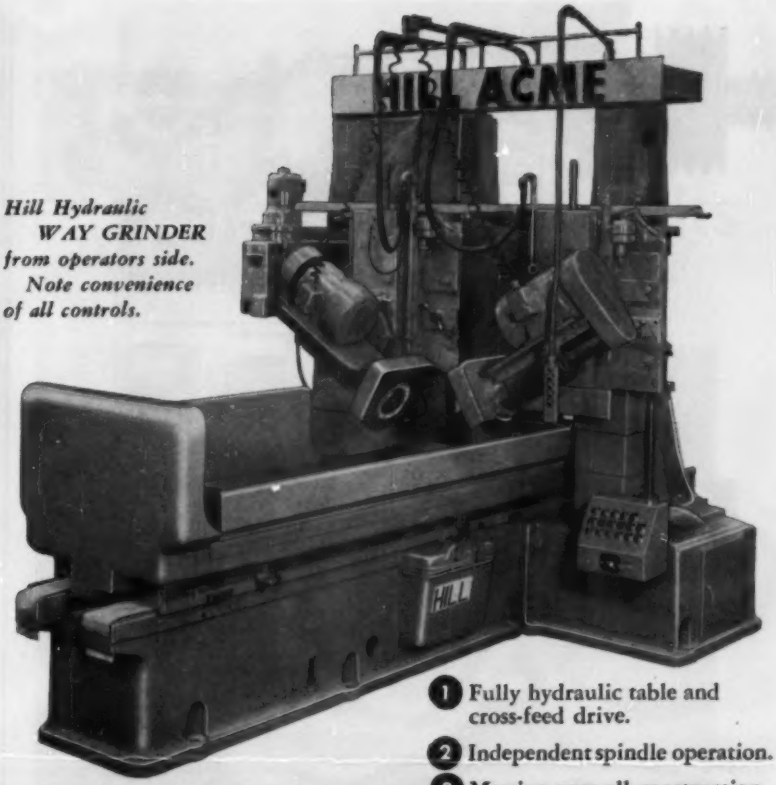
I am aware that non-technical people *have* hit on good mechanical ideas—a minister of religion is credited with inventing the agricultural self binder—but there must be many in Malone's squad without a hope, and on them, the hour's education would be, largely, a dead loss. If Malone knows his job and his men, he will be well aware of the non-starters and the "also rans." Why waste an hour on them and lose an hour's production for which, presumably, they were hired to do? If men in the engineering department, trained in design and accustomed to accurate calculation, cannot improve the catch on Model 71, Malone would seem to be clutching at straws, educating his whole squad on all of the company's products in the slender hope that one or more of his men might beat Engineering at their own job. I submit that a speedier, more direct, less costly approach would be for Engineering to list its failures, have them posted on the shop notice board and call for solutions which, if acceptable, would be generously paid for.

The probables would rise to that one, but the whole squad would not be paid for an hour in which it produced nothing. That method would make things easier for the shopmen and would go straight to the roots of Engineering's trouble, if, as Al holds, the catch on Model 71 has got them beaten. It is always easier to answer a stated case than to think up an idea from the raw. Al is really seeking a remedy in the wrong quarter. Ed has got the right idea; Engineering should do the thinking when it comes to problems of design. It isn't good enough to pass the buck to nontechnical operators in the shops if Engineering cannot do

"I don't think he wants to go to work today!"

HILL double housing WAY GRINDER for accurate grinding of V's, Flats and Angles

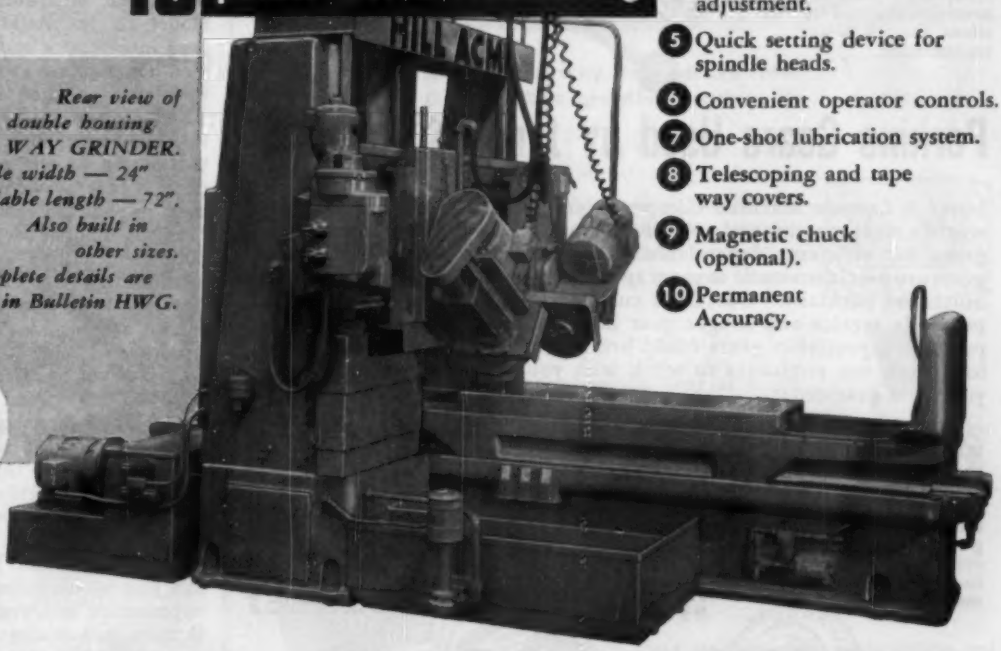
Substantial Savings (up to 50%) over previous methods.



Hill Hydraulic WAY GRINDER from operators side. Note convenience of all controls.

10 points worth considering

1. Fully hydraulic table and cross-feed drive.
2. Independent spindle operation.
3. Massive over-all construction.
4. Rapid traverse and fine feed adjustment.
5. Quick setting device for spindle heads.
6. Convenient operator controls.
7. One-shot lubrication system.
8. Telescoping and tape way covers.
9. Magnetic chuck (optional).
10. Permanent Accuracy.



Rear view of HILL double housing WAY GRINDER. Table width — 24" Table length — 72". Also built in other sizes. Complete details are given in Bulletin HWG.

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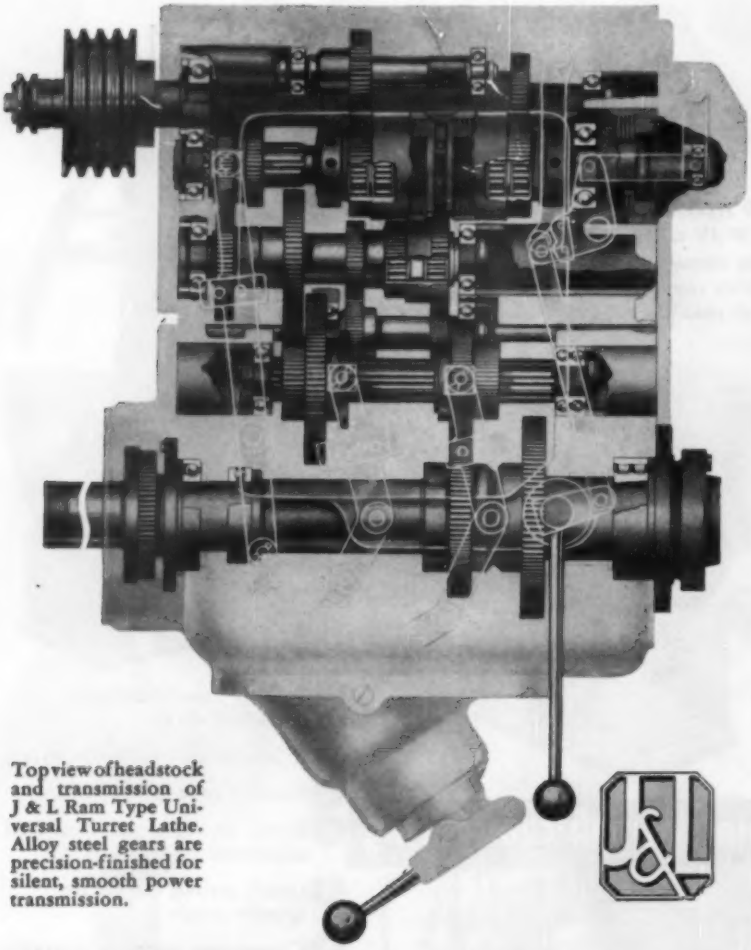

Top view of headstock and transmission of J & L Ram Type Universal Turret Lathe. Alloy steel gears are precision-finished for silent, smooth power transmission.

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Jones & Lamson Machine Company, famous as manufacturers of the world's most accurate and powerful turret lathes, use Perkins precision gears for efficient, dependable performance. Perkins custom-cut gears are precision-made to exact specifications. They eliminate wear, noise and backlash. Our OEM customers know Perkins means dependable service and longer gear life. Perkins' long experience in producing precision gears could bring profitable benefits your way, too! Ask our engineers to work with you designing or estimating your next gear order.

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Dept. 46, West Springfield, Mass.
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its job. It's a waste of time and money attempting to educate shopmen to do Engineering's work. It's a pantomime idea that no sane foreman would support.

Decidely, Malone should leave the engineering to the engineering department. If Engineering is as dumb as Al asserts, the weakness in that department should be corrected by engaging personnel capable of doing all the jobs peculiar to machine design. Another department, less favorably placed, should not be laid idle for an hour in order to attempt teaching Engineering its job. If no one in Engineering can solve the problem of "the miserable catch on the model 71," new blood is called for in the department. If Al's company put the problem up to the readers of *American Machinist*, it would be solved in the following issue. The proper way to handle the problem is for higher management to examine the cause of Engineering's failure, and apply the remedy.

Put Engineering in a position to do its own job efficiently and leave the shopmen to get on with theirs, instead of wasting valuable production time trying to teach them a job which is obviously beyond them. If Al "could get a couple of hundred men thinking about a way to improve that miserable catch on the Model 71" he would probably succeed in getting a couple of hundred men *not* thinking about the shop job they were engaged and paid to do. Al should concentrate on high quality, high production. If he can get that across, he will render the company signal service. He does not seem to have the answer to the catch problem, neither does Malone, yet both seem willing to mortgage production time in an effort to teach the men how to do what they themselves cannot accomplish. What an absurd situation.

This is not to discourage the men from thinking about their work. It is merely to discourage the low IQs from *not* thinking about their own work, in order to think about other people's. The fertile brains in the shops can be depended on to spot poor design if it makes their job more difficult than need be. They can also be depended on to suggest appropriate improvement, more so, if there is a money award for constructive thinking.

"Fertile brains" does not, of course, mean whole squads; that would be too much to expect. I am wholeheartedly with Ed, here. The hour's talk to the squad is money down the drain. Only a very few would benefit and they would bene-

fit because they were keen and interested. A suggestions scheme with attractive money awards would get positive results without loss of production time. The brains of the bright lads would be stimulated by the thought of a cash payment worthy of the occasion. There would be no need for pep talks, they would do the talking.

D Mack
Lanark, Scotland

APPLICATION FOR TROUBLE

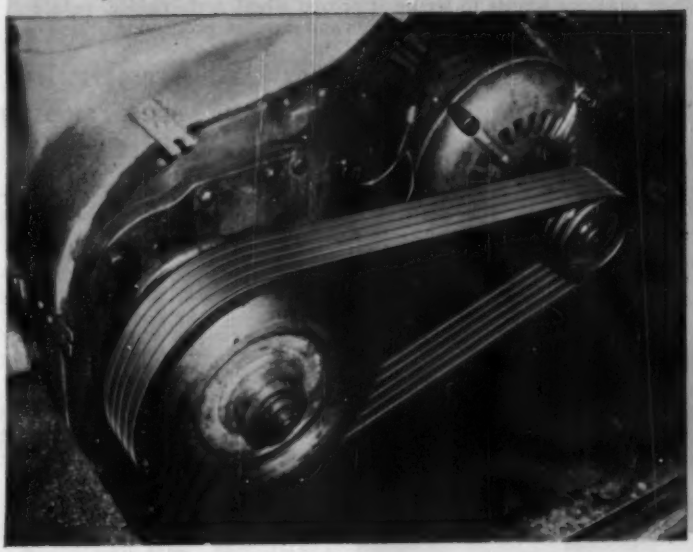
Is it practical to fire a man for falsifying a fact on his employment application blank? If his work is satisfactory, and he gets along with his foreman and the other men in the shop, should he be dismissed for a misstatement made when he applied for the job?

THERE WAS a time when the foreman could deal with each individual rather than the group. He could hire or fire without a lot of red tape. As industry expanded it was necessary to set up new departments. With this expansion, standardization, uniformity, and policy became necessary. The foreman cannot buy his own materials; costs are involved. It was necessary to hire specialists. Buying standards were established, consistent with the market. Inventory controls had to be introduced. Production control and time study became necessary. They all became an aid to the successful running of a business.

We have had to accept these things and grow up with them. We often find fault with these departments. Most times it is lack of understanding of each other's function. Each

"Welcome back from Europe, Mr. Gilmartin . . . I know you'll find everything in perfect order."

CONCAVE SIDES make V-belts last longer



***See for yourself* why the concave sides (Fig. 1) of a Gates V-Belt greatly lengthen its life. Just do this:**

Bend a Gates belt and feel the sides. Note how these precisely engineered concave sides *fill out* on the bend and *become straight*. Thus a Gates belt grips the sheave groove evenly (Fig. 1-A) and wear is distributed uniformly across each side of the belt. That means longer belt life; lower costs.

Fig. 1

Fig. 1-A

Make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating the wear at points shown by arrows.

For longer belt life...lower belt costs, specify the V-belt with Concave sides—Gates Vulco Rope...readily available from nearby distributor stocks.

Fig. 2

Fig. 2-A

U. S. PAT. NO. 1813698

TPA 151

World's Largest Maker of V-Belts

The Gates Rubber Company

DENVER, COLORADO

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and in 70 other countries throughout the world.

Gates VULCO ROPE Drives

Why MICROHONING

Lowers Costs, Increases Production, Improves Quality of Grinding Wheels

Bay State Abrasive Products Company, one of the largest and most progressive manufacturers of abrasive products, Microhones the arbor hole of their snagging wheels to secure improved wheel performance, reduce manual handling, lower processing costs and increase production.

Why Microhoning Saves Time, Energy and Reduces Processing Costs of Arbor Holes over 50%:

1. **Less Equipment**—one Microhoning machine does work of two grinders.
2. **Less Operating Costs**—Microhoning processes 450 to 600 grinding wheels per set of abrasive sticks; abrasives cost was substantially higher with former grinding method.
3. **Less Maintenance**—Hydrohoner has no chucks to maintain and there is now only one machine instead of two.
4. **Less Gaging**—Microhoning *automatically* brings arbor hole to size within .003" tolerance; former grinding method required repeated gaging during operation.

Why Microhoning Improves Performance of Grinding Wheels:

1. **Better Fit**—inherent qualities of the Microhoning process are geometric accuracy and ability to hold close tolerances . . . rounder and accurately sized arbor holes assure a better fit.
2. **Less Arbor Wear**—Microhoning cuts both abrasive grain and resinoid bond while producing a smoother hole.
3. **Less Chatter**—Microhoning assures arbor holes that are square with faces and more concentric with O.D.

See page to right for "How Microhoning" accomplishes the above results.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

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one of us is important, each having our own specialty and talent. We are welded to one organization for teamwork and cooperation to the final sale of the product.

I often found myself questioning the policy of the personnel department. It is sometimes necessary to talk things over in a friendly way. Most men who head up departments will admit their mistakes. A general discussion will usually clear the air to mutual satisfaction.

The foreman, however, should not feel bad about being overruled. His boss has also been overruled many times. I think the thing we must always remember is to look for opportunities to serve the staff, and also have them serve you. In these problems you forget personalities and get together to decide "What is the right way to look at this?"

A E Salmons
Norristown, Penna

PERSONNEL DEPARTMENT, while having a right to look into the behavior of men seeking jobs, should let Ed alone, with few exceptions. For instance, if Ed happened to recommend hiring a criminal whom he knew nothing about except that he thought he was a good worker when accepting him, and Personnel found out he was a dangerous guy, then Ed should be told to get rid of him in a quiet way. The same method should be employed if a notoriously known thief had happened to get inside the shop. Morale must be upheld, and gangsters of all kinds should, of course, be kept outside any factory or place of work.

If I understand this story correctly, Potts' misconduct consisted only of using some irregularities in his application for employment. As Al points out, the rules in his shop disqualify the man if he uses anything phony on his application. But if his phony act was only that he didn't put down his last employer as a reference, he should not be fired unless by doing so he tried to cover up some serious offense. Personnel should find this out before taking any step to have him discharged.

As Ed says, there is nothing wrong with Potts, and he is a good worker. He might as well be kept, even if he had trouble with his last employer. Everybody must be given a chance to do better if he regrets his previous misconduct or mistakes. The trouble Potts had with his last employer might be that he spoiled some workpieces, and that cannot

possibly be counted against him morally in his new employment. Maybe he turns out to be a good profit maker for his new employer after he has got proper instructions for his new job. A couple of times I have even hired men who told me they had been petty thieves, but that they never again would steal anything. They turned out to be good fellows.

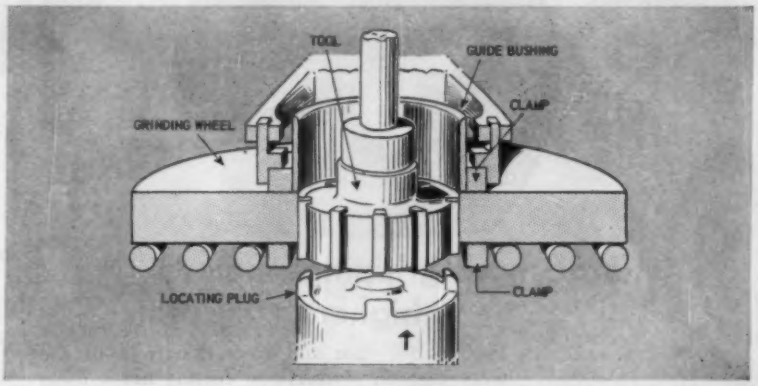
I don't agree with Al that Ed should fire Potts simply because he made a bluff on his application as told in this story. Potts may have had good reasons on hand not to expose himself nor his last employer. I think many shop executives misrecommend some of their helpers without adequate reasons. Yes, I know cases myself where good men have been misrecommended because they had been rivals about the same job that their foreman was looking for. Some executives have also got their jobs through some high-brass relative of theirs although they morally and technically were far below the average. Don't think for a moment that every employer's or executive's morals are above reproach!

I am sure Ed is right when he doubts that the error on Potts' application was important enough to let him go. Bad references are serious things, and they may be wholly unwarranted. Some young impulsive executive thinks he is in his rights, or has the idea that he is doing his employer a favor when misrecommending somebody. He does not realize that by giving a man a bad ref-

"'Basic fasteners of universal application,' my foot! . . . why can't you ask for screws like everybody else?"

How MICROHONING Lowers Costs, Increases Production, Improves Quality of Grinding Wheels

By changing from grinding to Microhoning of arbor holes, Bay State Abrasive Products Company has realized substantially lower processing costs, raised productivity and improved the performance qualities of their snagging wheels.



Here's How Microhoning Now Saves Time, Labor, Material and Processing Costs:

1. Snagging wheels now travel from facing machine to Hydrohoner on a conveyor—there is no manual lifting or handling.
2. A disappearing plug automatically locates wheels in Hydrohoner where they are clamped on the faces and remain stationary during Microhoning operation—there is no manual placing of wheels on chucks, or chucks to maintain.
3. One Hydrohoner does work of two grinders; and one set of Bay State iron bonded, diamond sticks Microhones from 450 to 600 resinoid-bonded wheels—less equipment to maintain and lower costs for abrasive.
4. In approximately a minute, Microhoning removes from .030" to .070" of stock from arbor holes ranging in diameter from 6" to 12"—processing is faster and material is saved because wheels can now be molded closer to final size.
5. Microhoning tool automatically holds diametric accuracy within .003" tolerance—repeated manual gaging is eliminated.

See page to left for "Why Microhoning" provides cost-and-time-saving benefits.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

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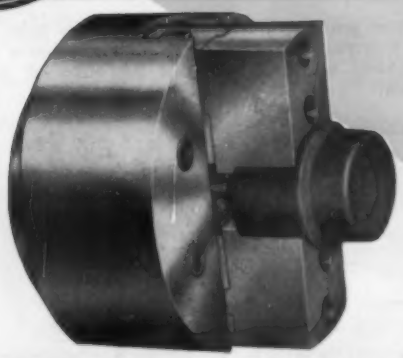
S-P POWER CHUCKS



for more gripping power– higher production

Famous S-P cam and lever design holds the work tighter, permits cost cutting heavy feeds and multiple cuts. S-P cam and lever design also resists opening of jaws by centrifugal force or diminishing air pressure . . . an important safety factor. Balanced for high rpm.

S-P SELF-CENTERING CHUCKS are built in Universal American Standard models, sizes 6" – 8" – 10" – 12", and Serrated models in 8" – 10" – 12" sizes. Two or three jaws.

S-P COMPENSATING CHUCKS grip out-of-round work with equal pressure on each jaw. Available in 8" – 10" – 12" sizes, two and three jaw models, American Standard or Serrated.

S-P ROTATING CYLINDERS

Air and Hydraulic

Adequate stroke for long jaw travel of S-P Chucks. Balanced for high rpm on machine tools and other applications. Details in Catalog No. 105 (Air) and Bul. 201 (Hydraulic).

S-P Power Chucks are installed as original equipment by Bardons & Oliver, Cleveland Automatic, Cone Automatic, Ex-Cell-O, Jones & Lamson, Monarch, Warner & Swasey . . . and many others. Representatives in principal cities. Prompt deliveries. Send for catalog No. 105. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio.

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NON-ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS
POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

erence, he might ruin the rest of that fellow's life as far as getting a good job is concerned. If an executive cannot give a man a good reference he should keep his mouth shut.

Everybody has the right to try to avoid being put down, even if using a minor bluff on an application. This should not be considered a gamble. There are many things an executive may consider an offense, that the offender need not accept, perhaps with better reasons than his judge.

Hidden flaws? Who is ready to throw the first stone? If all the hidden flaws could be exposed among men, there would not be many without them. Why not start with Al to find out about his own hidden flaws? There might be several.

A E Fristedt
Stockholm-Bromma, Sweden

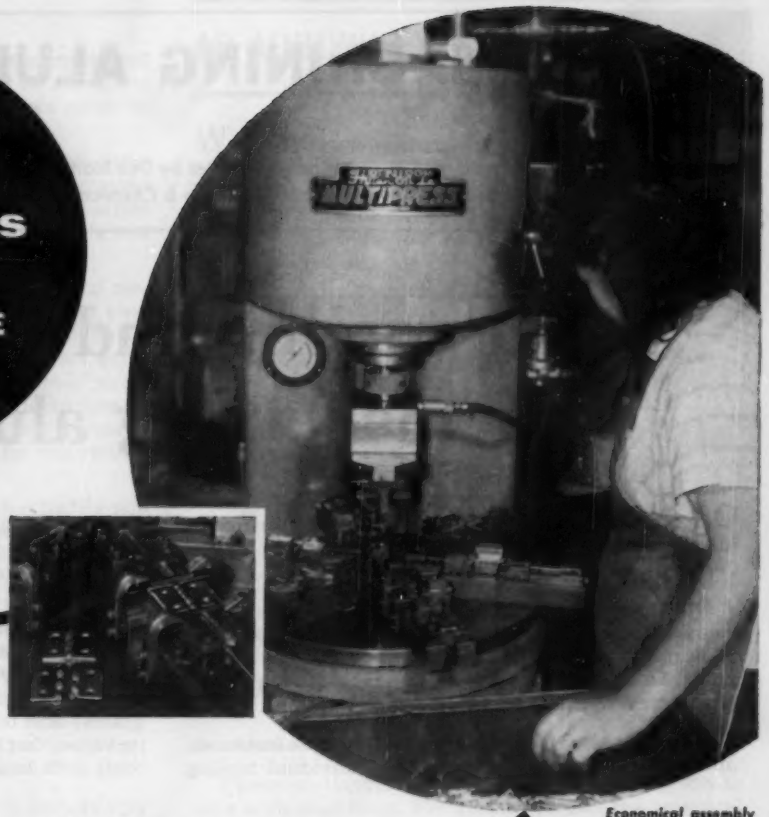
I'LL HAVE TO START this with a text: "Let him who is without sin be the first to throw the stone" and then try to resurrect the preacher instinct within me to follow through. While I am a stickler for honesty, inclined to call a spade a spade regardless of whose little piggies I may tread upon, I'll have to confess that during my lifetime I have pulled a few of these "shady" deals in order to avoid what I considered at the time as unnecessary complications which would have ensued had I held rigidly to the line.

While Potts stands trial for his so-called crime, I face the jury, as his defender, and present my final plea. Let us lay all the cards on the table. There are times, I feel, when a little, so-called white lie helps out in an emergency and does no particular harm. The longhairs may shout, "It's a lie, nevertheless; it's not the absolute truth!" Horsefeathers! Perchance the unfortunate Potts is guilty of one of these harmless coverups and it seems to have backfired. As a consequence, the poor chap has been grabbed by the scuff of the neck and kicked out of his new job just because he thought it prudent to juggle some facts in order to cover up an unfortunate situation which took place between him and the foreman on his last job. The chances are, ten to one, that he was dealing with a situation in which he, being the underdog, had to bow out of the picture and found himself out of a job.

What Potts did in filling in a fictitious name as one of his former

(Continued on page 258)

How **DENISON MULTIPRESS** serves the **HARDWARE INDUSTRY**



Economical assembly of hardware hinges *is accomplished at low cost at Jaybee Mfg. Corp., Los Angeles, California. Multipress and table cycle at rates up to 2500 an hour to pace assembly operation.*

Assembles 2500 parts an hour at **JAYBEE** Mfg. Corporation with **DENISON** Hydraulic Multipress

Building hardware is being assembled here at rates of 2000 to 2500 units an hour, depending on size. Operators have only to load component parts. An indexing fixture with air operated clamps carries parts to the pressing station . . . holds them and sets rivets.

Because of its hydraulic ram operation, the Multipress is quickly and easily set for each type and size of hinge to be assembled. And since the ram pressure is duplicated exactly on every stroke, damage to assemblies through improper loading is eliminated, cutting scrap and saving material and labor cost.

Whether your work is light or heavy, small or high production, there is a Multipress from 1 to 75 tons that can save now on expensive operations in your plant. Have your Denison representative show you how. Write Denison Engineering Division, American Brake Shoe Co., 1164 Dublin Road, Columbus 16, Ohio.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics

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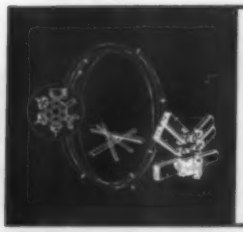


MACHINING ALUMINUM

OPERATOR REPORTS

This report is one of a series by Deo Blott, Technical Specialist, Kaiser Aluminum & Chemical Sales, Inc.

Basic tooling and tool angles for machining aluminum

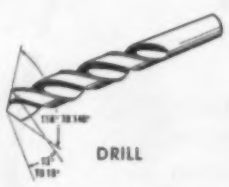
ONE OF THE first questions raised when considering the use of aluminum in automatic screw machines is this: "What changes must be made in tools?"

Often, *no changes* are required! A major automobile company recently converted several parts from brass to aluminum with no changes in tools, tooling or cutting fluids. This is typical of the experience of many producers of screw machine parts.

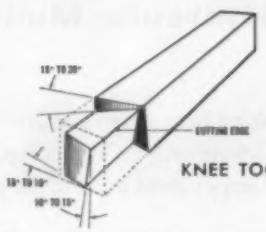
Of course, changes will be required in some instances, and specific recommendations for individual tooling setups are impractical because of the variation of individual jobs that may be performed. What may be satisfactory tooling in one shop may not meet the requirements of another.

But by taking as a guide *tooling practices that have been proved successful*, individual operators and shops can quickly determine exact specifications to meet their particular requirements. Thus, the tool angles (see diagrams) and tool discussions presented here are based on values that have been carefully considered to provide tools with *basic requirements for satisfactory cutting.*

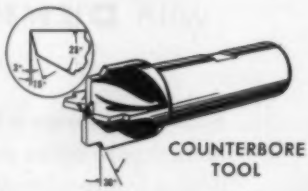
RECOMMENDED CUTTING TOOL ANGLES FOR MACHINING ALUMINUM



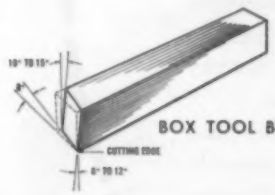
DRILL



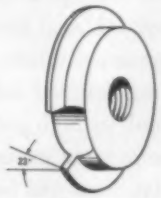
KNEE TOOL



COUNTERBORE TOOL

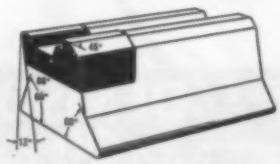


BOX TOOL BLADE



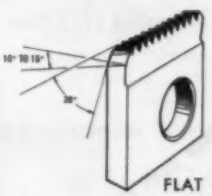
CIRCULAR CUT-OFF TOOL

SPIRAL FLUTE TAP



DOVETAIL FORM TOOL

REAMER



FLAT CHASER

High-Speed Steel Tools

At the present time, high-speed steel is the most-used material for all types of cutting tools used on automatic screw machines. Production requirements in most instances can be met with such tools.

High-speed steel tools include the tungsten-chromium and vanadium alloys, the molybdenum-tungsten types, and the cobalt high-speed steels. A few carbon steel tools are used, especially where small drills and taps are subject to a high percentage of breakage.

When high-speed steel tools are employed to machine aluminum, considerable attention must be paid to grinding tool angles, clearances, and final tool finish. Too often, it is assumed that a tool should work satisfactorily even when ground by "rule of thumb" practices. Much trouble can be eliminated by discarding all such practices, then centering attention on systematic study to obtain optimum cutting angles for the various aluminum alloys.

Numerous case studies have proved that highly polished surfaces, such as flutes in drills, taps, and reamers, aid in chip movement and retard edge build-up. Where chip breakers are ground into cutting tools, smoothly polished contours will help determine the shape and size of the chip. In machining aluminum, the better the finish applied to a tool, the better the results in higher production, less down time, and lower tool cost. High finish assumes mirror-like surfaces to micro-dimensional smoothness.

Cemented Carbide Tools

The application of cemented carbides is increasingly important to the machining of aluminum—and unique in that the optimum speeds for machining this metal are not usually attainable! Some present automatic screw machines do not provide the spindle speeds necessary to take full advantage of the cutting characteristics of aluminum with carbides.

In most instances, the surface foot rate at which aluminum can be turned, faced, or bored with tungsten carbide tools is unlimited. Minimum speeds of 500 sfpm are acceptable and in light finishing operations, 1100 sfpm is not excessive. More specifically, as the hardness, work-hardenability, or abrasiveness of the alloy increases, lower speeds and heavier feeds are desirable. Higher speeds and, if necessary, higher feeds are applicable for alloys not possessing these characteristics.

* * * *

The tooling information presented above was condensed by Deo Blott from the booklet, "Machining Kaiser Aluminum With Automatic Screw Machines." If you would like a copy of this booklet, please use the coupon at the right.

And to further help you machine aluminum effectively, Mr. Blott will go to your shop to recommend practices proved best by operators experienced in aluminum. Mr. Blott has been machining aluminum on automatics since 1934, and is an acknowledged authority on using aluminum in screw machine operations.

For this advisory service, or for detailed information on any phase of machining aluminum, contact Kaiser Aluminum or see your Kaiser Aluminum distributor.

Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

AN ALUMINUM COST STORY (No. 1)

WHITE-RODGERS COMPANY, makers of temperature controls for heating and air-conditioning equipment, had long used brass for their parts numbers 74-0612 and 55-0466 (shown below). But a simple *specification change*—from brass to Kaiser Aluminum—virtually cut their costs in half!

Part #74-0612, Stud

46.2%

SAVING per 1,000 pieces when converted from brass to aluminum

Part # 55-0466, Nut

42.6%

SAVING per 1,000 pieces when converted from brass to aluminum.

These two conversions demonstrate how easy it is to save with aluminum. For aluminum met the principal operator requirement—*machinability*. (Both parts were converted with virtually no change in machining speed and setting.) And aluminum met the principal management requirement—*savings*.

To help operators introduce savings like these for the parts they produce, Kaiser Aluminum offers expert on-the-job technical assistance plus complete, up-to-date information on machining aluminum. Send the coupon today for your free copy of "Machining Kaiser Aluminum With Automatic Screw Machines"—52 pages of valuable technical data and tooling information.

KAISER Aluminum

THE BRIGHT STAR OF METALS

Kaiser Aluminum & Chemical Corporation
Box AM-10, Technical Publications Department
919 N. Michigan Ave., Chicago 11, Illinois

Gentlemen:

Please send me, without obligation, the free booklet, "Machining Kaiser Aluminum With Automatic Screw Machine."

NAME_____

ADDRESS_____

CITY_____ STATE_____

COMPANY_____

shamrock

top performer for automatic screw machines

Shamrock, a water-soluble chemical emulsion combining good cooling and extreme-pressure lubricating properties, is giving excellent service in single and multiple spindle automatic screw machines. It is also widely used when machining at moderate feeds and speeds for broaching, threading and tapping, as well as for drawing and stamping. It contains no sulfur or chlorine commonly used as extreme pressure additives, and it completely eliminates all smoke nuisance as well as the dermatitis problem. Shamrock helps keep any shop clean.

RESULTS THAT COUNT

Using Shamrock 5 to 1 a prominent Illinois manufacturer (name on request) increased tool life approximately 2½ times and entirely eliminated the smoke nuisance from the following operation: The work was drilling and tapping railway track and switch controls, the material 1020 and 1040 hot rolled steel, the speed 170 RPM, 50 RPM faster than possible with the previous coolant.

Send for descriptive literature.

The Lusol Line
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 215, PORTLAND, CONNECTICUT
Branch Offices in Chicago, Detroit and Los Angeles
Distributors in other principal cities

employers is not so criminal as it may at first seem; the man was just trying to cover up an unpleasant situation. I feel that Potts was just being tactful to a degree which was frowned upon by the employing dilettantes to the extent of saving their own faces.

I've had many a set-to with some of my past foremen and I suppose that I am very fortunate that such things as personnel departments were not in vogue at the time — at least not where I was concerned. On being fired from one job for sticking up for what I thought was right I could have been unjustly blackballed for another, but fortunately, luck was with me. It so happened that when I applied for another job I was given a chance to talk with the foreman and did not have to submit to the snooping inquiries of some lamebrain who held a degree of some sort in angular psychology. (That's the kind where the couch is tipped!) I had the chance of telling the hoped-for foreman what had happened at the Screwball Clamp Company and while the gentleman scratched his chin reflectively he didn't waste words in assinine questions, but seriously studied me for signs of deception. I lugged in my toolbox the next day and enjoyed some years of happy association and profitable experience. One of the gripes I have against modern industry is that paper work has replaced genuine personal contact between the head of a department and the applicant for a job therein.

Instead of such a disgraceful way of treating a new man, wouldn't it have been better for the head of Personnel to have had a serious talk with this fellow Potts to find out why he had filled in his application as he did? The possibility is that the truth would have been brought to light and the man be found justified in doing as he did. I cannot see why a man should not be given another chance to vindicate himself for an act of momentary indiscretion.

What do you think would have happened to Potts had he made the statement that he hesitated to mention the name of the last employer because of something he did not feel inclined to discuss? Do you think that Personnel would have appreciated the man's honesty? Oh no! He would have been branded — right now — as being decidedly unsuitable for employment.

I started this out with a well known text so now I will end it with one of my own: "Don't let the practices of a few unprincipled fore-

IN CUTLERY, TOO,

Sharonsteel Quality STANDS OUT

• Cutlery manufacturers know well the name SHARON, for in the past five decades SHARON has excelled in the production of steels used in the manufacture of implements for cutting.

From exquisite carving blades to rugged chain saw teeth, razor sharp scalpels, agricultural and earth moving equipment SHARON provides the edge holding and abrasion resistant steels manufacturers can trust.

If you make products that require cutting edges that endure we suggest that you contact the SHARON representative nearest you and take advantage of this vast library of experience.

SOMOROFF-N.Y.

SHARONSTEEL

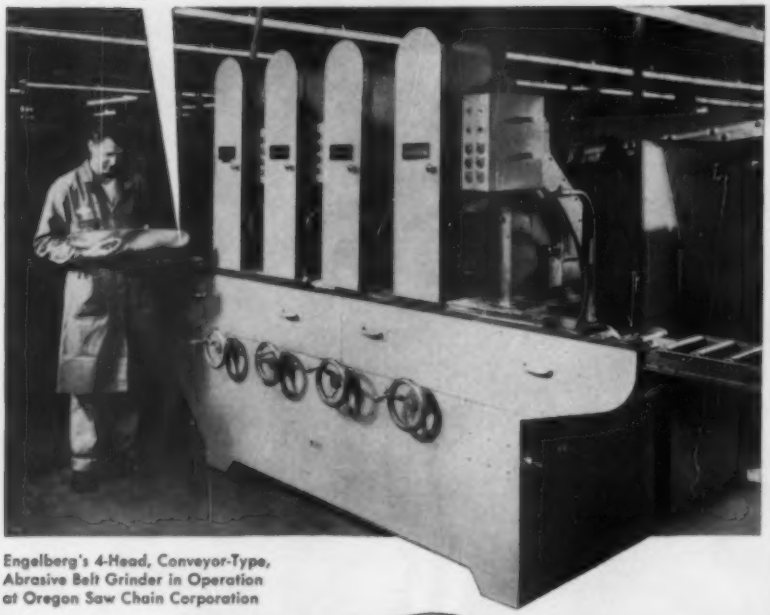
For 56 Years a Quality Name in Steel

174

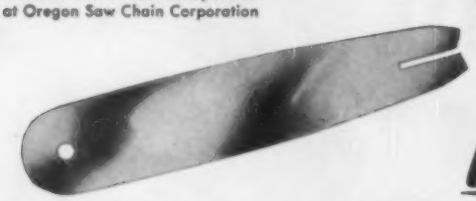
SHARON STEEL CORPORATION, SHARON, PENNA.

CAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, SEATTLE, MONTREAL, TORONTO

HOLDS .001" TOLERANCES BETTER THAN OTHER GRINDERS TESTED... COSTS LESS: PRODUCES MORE



Engelberg's 4-Head, Conveyor-Type, Abrasive Belt Grinder in Operation at Oregon Saw Chain Corporation



Finished to .001" T.I.R. in one pass by Engelberg 4-head, conveyor-type, abrasive belt grinder.

ACTUAL TESTS PROVE PRODUCTION PERFECTION

After a nationwide tour testing grinders of various makes and kinds, the Oregon Saw Chain Corporation bought an Engelberg #680, 4-head abrasive belt grinder. Improvements in product and production have more than offset the investment, the Company says.

The Engelberg #680 provides through-feed as against the reciprocating feed of the surface grinder. It produces continuously with no down cycles for loading and unloading. And it holds a total-indicator-reading tolerance of .001", better than any other grinder tested. Rejects run less than 1%.

Chain saw bars, heat treated to 42 Rockwell "C" hardness, are finished in one pass. Normal operation calls for the removal of .005" by the four heads at a rate of 10'/min.

ENGELBERG Abrasive Belt Grinders

are available with 1 to 6 grinding heads. Send a sample part for cost-and-time-savings estimate... or an Engelberg Production Engineer will be glad to call. No cost. No obligation.

ENGELBERG

HULLER CO., INC.
184 Seneca St., Syracuse, N. Y.

men dictate the policies of justice in dealing with the jobless unfortunate."

John Homewood
Laguna Beach, Calif

A PERSON WHO WILL TRY to get by with false data on an application will also get by, or at least try to do so, on the job. Human nature seems such that once a thing is done with any degree of success, we try it over again until it won't work or until our own physical being rebels.

Potts may have been a good worker, but somewhere in his mental makeup he was a little off balance with the rest of our present social structure. What his reasons were for the false name should naturally be investigated, but not by the foreman. Perhaps not by the personnel department — both might be too much prejudiced. If the grounds were such that it appeared and was proven that Potts' claim was false and for no good reason except fear of a bad reference, then certainly he should be automatically dismissed.

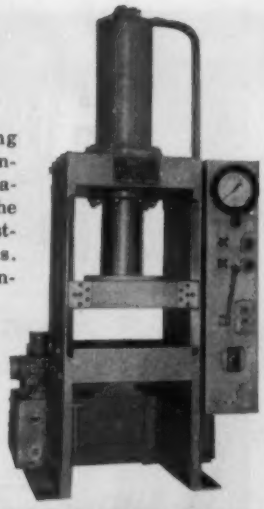
Certainly the work or type of work that a man has done in the past gives him the basis for being able to handle similar work in the future. How he gets along with his immediate superior is a question which is very debatable. If he likes to see progress and his boss does not, then certainly they will clash. But who is right? Naturally the boss is always right when it comes to future recommendations. Thus, if the person who desires to see progress clashes with a superior who thinks in opposite terms, then when a reference is to be obtained, he can only expect the worst, insofar as any remarks as to his ability to get along with people go.

Yet we all know that compatibility is the thing which shows off a person best and to the best advantage. Wouldn't we be much better off in these days of a tight labor market to judge people on their ability to work on the job? Judge them on their ability to accomplish the work set before them and *not* upon their ability to get along on a previous job, which virtually means with his last immediate superior. It could happen (and would frequently be proven to be the case) that the man was liked by all in the department except the boss, so that the recommendation is not a true picture of the man and his ability to get along with others.

Oh yes, it has a bearing, but too

ERIE

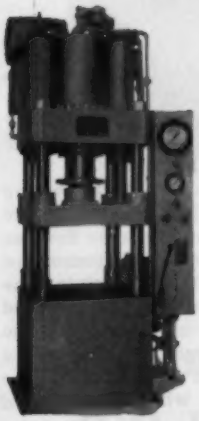
SINCE 1895



75-ton down-moving press of side plate construction. Moving platen is guided on the four-corners by adjustable guide plates. Pressing speed is manually controlled.

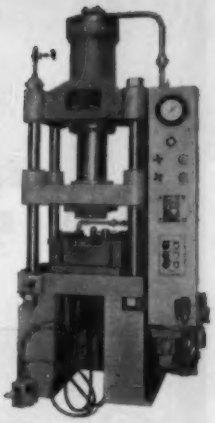
For increased efficiency of metalworking operations

ERIE FOUNDRY HYDRAULIC PRESSES

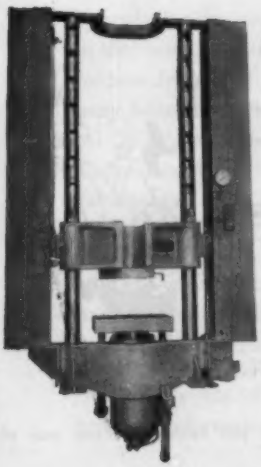


125-ton manually controlled riveting press. Designed to clamp motor laminations and upset rivets. Features upper and lower 75-ton riveting cylinders, two 25-ton double acting clamping cylinders.

These **4** *hydraulic presses . .*



75-ton self contained semi-automatic hydraulic press used to rivet electric motor components. Adjustable speed, tonnage.



200-ton two-rod forcing press with a power driven moving abutment. Opening is adjustable in increments of 12". Sensitive manual controls with 24" working stroke.

were designed and built by Erie Foundry Company for one of the country's leading electrical manufacturers. Although each press was designed to perform a specific operation with increased efficiency, they are easily adaptable to many uses. These presses demonstrate a range of design and feature both semi-automatic and manual operation. Each Erie Foundry press allows its operator to control his work precisely.

If a hydraulic press can reduce your manufacturing costs, it will pay you to talk with one of Erie Foundry's engineers to discuss your specific requirements. Just write.

Hydraulic Press Division

ERIE FOUNDRY CO.

ERIE 4, PA.

Atrax PROGRESS REPORT

SOLID CARBIDE TOOLS

CASE HISTORY #16
MID-WEST HEAVY MACHINERY MANUFACTURER

Atrax
7/16" & 1/4"
REAMERS
Series 1564

OPERATION — Reaming 7/16" x 1/2" deep hole; Reaming 1/4" x 5/8" deep hole
MATERIAL — Cast Stellite, Rockwell C48
SPEED - FEED — 7/16" dia.—350 r.p.m.; 1/4" dia.—900 r.p.m.
PRODUCTION — 100 to 180 holes per tool. Carbide **Tipped** reamer produced 10 holes. H.S.S. none.

CASE HISTORY #25
MAJOR AUTOMOBILE MANUFACTURER

Atrax
SPECIAL
END MILL
3/8" diameter
Series 1507

OPERATION — Milling transmission bodies. Plunge 3/4" and slot 7/8"
MATERIAL — Cast Iron
SPEED - FEED — 3840 r.p.m.—.0024 feed per revolution
PRODUCTION — 60,000 to 70,000 slots per tool. Previously used 1000 H.S.S. End Mills per month, now uses 24 Atrax mills.

CASE HISTORY #42
MAJOR AIRCRAFT CORPORATION

Atrax
H-183 and K-183
BURS

OPERATION — Burring
MATERIAL — Kirksite Dies
SPEED - FEED — 15,000 to 20,000 r.p.m.
PRODUCTION — Solid Carbide Burs ran 1200 hours average before resharpening. Previously, resharpening H.S.S. burs cost company $100 a day.

Atrax

SEND TODAY for 96 page "STANDARD REFERENCE" on Carbide tooling!

THE ATRAX COMPANY
Newington 11, Connecticut

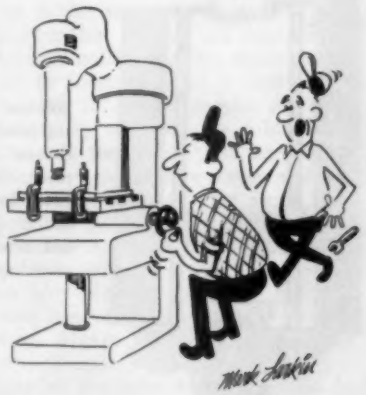
many personnel-department people rely upon hearsay from others and not enough upon being able to judge past performance from a written record and a personal interview. Both take time, and as all departments —in fact all company operations— are geared today to high speed, they refuse to take the needed time. They rely upon mechanical tests and upon others to okay or not okay the man, and little if any upon the man's own ability or his background.

Therefore, we do tend to drive people who have weak tendencies into making false statements on applications. This does not forgive them and certainly cannot be condoned. A personnel department should be well enough schooled and trained so that they do not hire a person who has falsified records. Certainly unless they are just grabing at straws they should not be too anxious to get a person on the payroll until he has been checked; that should not be done *after* hiring. The point is be sure before hiring.

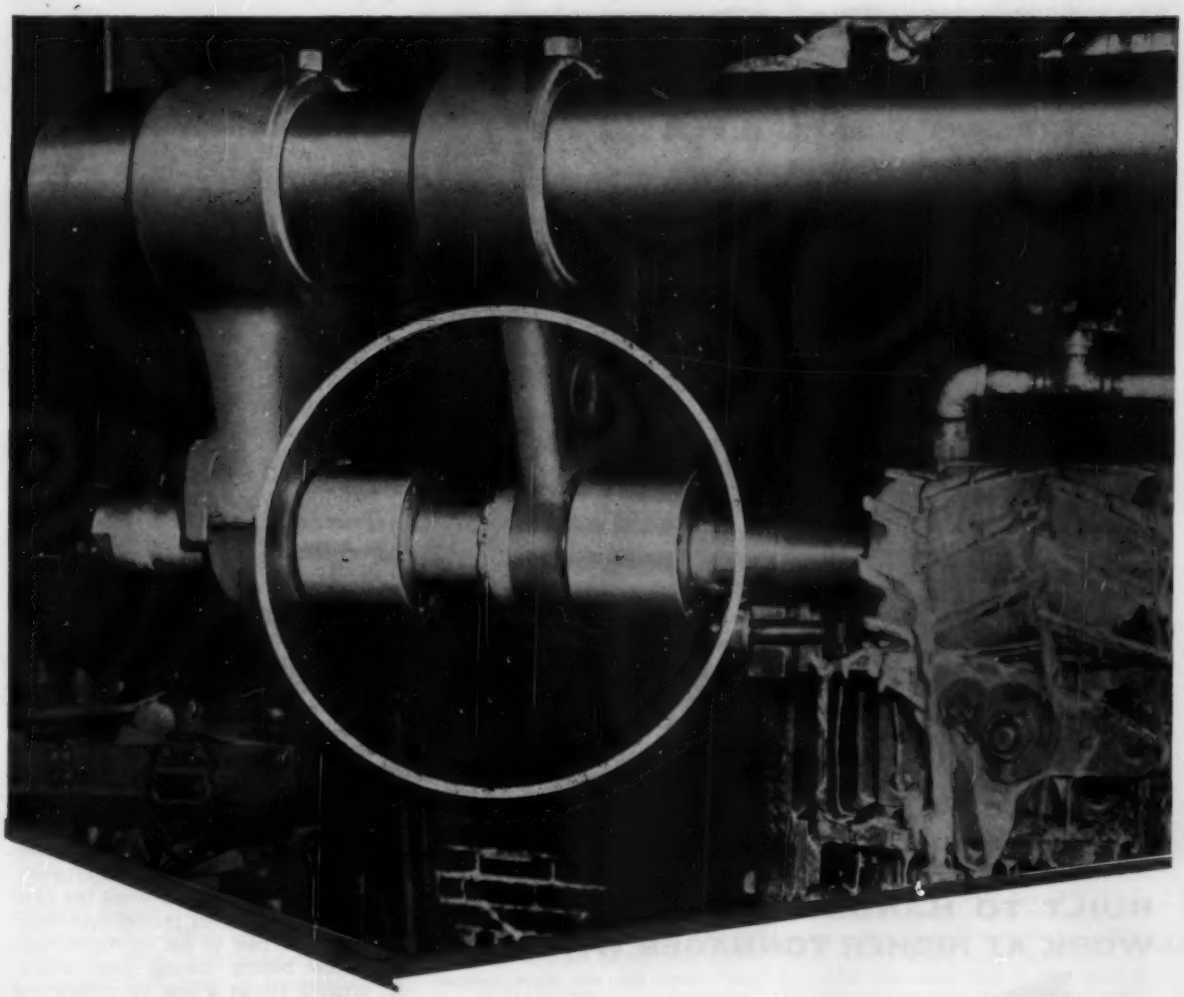
Charles D Townsend
West Hartford, Conn

SHOW ME ANYONE who hasn't made a mistake and I'll show you a freak of nature. We make progress by our mistakes, so let us consider Potts' affair with that in mind.

Potts did wrong but the wrong he did was not irreparable. We are all guilty of wrong in some form or another; we'll train our conscience to lie dormant while we violate some traffic law, some will sweat blood to put one over on dear, old Uncle almost every year at income-tax time; others will put a dime in the collection plate when they should



"Baxter, are you finished with my pair of microm . . ."



Bearings, Inc.

helps milling machine operators cut tool and maintenance costs – improve accuracy!

By replacing the usual bronze split-tapered bushing found on the outer support arm of most milling machines with the new Jergens Milling Machine Anti-Friction Bearing – many benefits are immediately apparent! At a large Central Ohio manufacturing company greater arbor rigidity, elimination of twisted arbors, frozen bushings and chatter was reported.

Maintenance costs are reduced $25 per machine, per month, according to our customer. Cutter breakage is no longer a problem and the milling machine operator is able to hold closer tolerances, it was reported.

This is only one of many bearing products, designed to improve performance and reduce costs, that we are authorized to distribute. For complete information and expert knowledge of all bearing applications call the branch nearest you today!

Providing bearing service in the territories adjacent to our branches, listed below.

BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Toledo • Youngstown • Zanesville
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WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling
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RUGGED

100 TON CAPACITY

Model No. 37K-MD-3

BUILT TO HANDLE LARGER, HEAVIER WORK AT HIGHER TONNAGES WITH EASE

Photo above indicates the heavy construction of bed plates — reinforced to provide maximum rigidity and minimum deflection.

SPECIFICATIONS

Ram Speeds — in./min.	18
Cylinder Bore — in.	7
Ram Stroke — in.	12
Daylight — in./max.	42¼
Opening, L-R — in.	45½
Between Bed Plates	11⅛
Motor, H.P.	7½/220/440-3-60
Shipping Wt. — lbs.	3025

STANDARD EQUIPMENT

1 pair notched V blocks; 1 pressure gauge, dual range P.S.I. and tons on ram; 1 bed adjusting mechanism; 1 flat ram nose; 1 auxiliary 2-speed hand-pump.

You won't have to baby this husky K. R. Wilson hydraulic shop press. Built to tackle the toughest jobs, it's the most rugged standard press of its type available. Heavy-duty, spring-return ram type hydraulic cylinder has a larger bore and longer stroke. This allows the press to handle the big jobs swiftly and safely with a minimum of bed plate adjusting. You get tremendous versatility too! The large, usable daylight opening between side members allows straightening of long pieces. Pressing bushings, shafts, wheels on and off, broaching, bending, coining, forming and drawing operations all can be handled with equal speed and ease. K. R. Wilson Motor Operated Hydraulic Shop Presses are also available in 30, 50 and 75 Ton Capacity. Get all the facts now on these rugged presses!

Get Full Details. Write for Bulletin No. 19

HYDRAULICS DIVISION

K. R .WILSON, Inc.

Offices & Factories — 210 Main St., Arcade, N. Y., U.S.A.

give at least a dollar. But let poor Potts write the name of a phony employer on his application blank and swish—down comes the blade! How can we consider a thing such as Potts did as being sufficient to justify the course taken by his new employer? Why wasn't the fictitious name recorded on the application blank recognized sooner? Perchance the discrepancy was first noted when an investigation was made and the letter returned with the usual, almost undecipherable note scribbled on the envelope: "No such outfit."

I know of a man who worked under an assumed name at one firm simply because he wanted a job where his brother worked. It was the rule there that no relatives could be hired. What would have been the reaction of another firm in finding out that an applicant had worked under another name somewhere else? Wow! That guy would have been stamped right then and there a crook to be handled with tongs. Now, getting back to Potts. If he had left the name of the previous firm off his application blank the chances are that he wouldn't have been given the air so abruptly.

Ed, the foreman of Potts, was justified in raising cain about the whole deal. I can readily see why he was so hot under the collar about the doings of the personnel department. In the first place they were the ones who had the wool pulled over their eyes and had to let so much time elapse before taking any action. What I am at a loss to understand is why Ed wasn't consulted before any action was taken. To me this was a slap in the face of the foreman who spent so much of his valuable time breaking in the man. Then, after discovering that he was such a good worker, to have him snatched from under him when good men were so scarce was enough to disintegrate the man's morale. What Ed should have done was to go to Harrison and raise particular hell so as not to have such a thing repeated.

Is there no consideration for extenuating circumstances in such a case? I'll gamble on it that the one responsible for Potts' dishonorable discharge is the type who picks up his ball in the rough and furtively tosses it on to the fairway. To me this is a greater wrong than filling in a phony name in order to cover up a disagreeable situation in which the probabilities are that he was not to blame. Inflexible rules are the concepts of long ears and pin heads. In every element of structure allowances are made for a certain amount

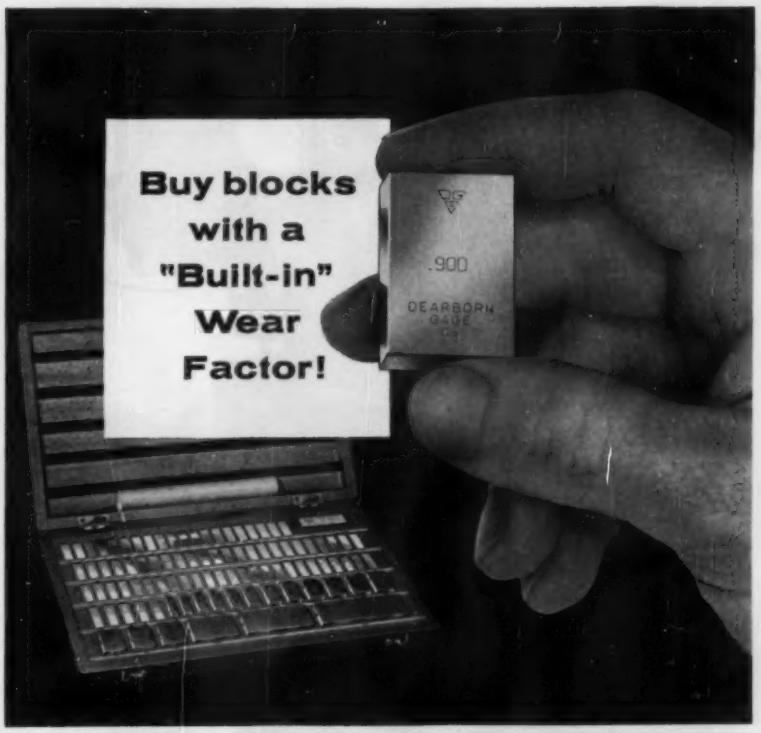
of give. The chances are that the one responsible for Potts' sudden exit will kiss his wife farewell of an evening and then take on a blonde or redhead for a session or two. His wife, if she found out about it, would be justified in giving him the bounce because such carryings-on are against the rules!

Well, Potts is gone—he's sore as hell at the whole thing and takes on a job of selling the Saturday Evening Post or something while, Ed, burning up with indignation, says to himself: "Another good mechanic sacrificed on the altar of damn foolishness."

Frank Van Horn
Auburn, Calif

THERE ARE THOSE who feel that an untruth sometimes justifies itself in view of the circumstances leading up to its expression. No doubt Potts felt this way about it and followed his hunch that the deception would go unnoticed. It is not a question as to whether Potts was right or whether those who brought about his dismissal were right. It isn't who's right but what's right. May I point out the Latin motto of our great state of Kansas, "Ad astra per aspera" which signifies "To the stars by hard ways." Potts may well benefit by this injunction because it signifies, in effect, that meeting difficulties head-on ends in conquering them. Thus the stars of accomplishment are reached through direct paths—not by roundabout tactics

"So what, it doesn't interfere with your operation in any way does it?"



ELLSTROM CHROMIUM PLATED GAGE BLOCKS are guaranteed "minus nothing" from nominal size!

Here at last are gage blocks with a positive "built-in" wear factor! The only blocks ever produced and priced as standard with dimensional accuracy unconditionally guaranteed to be within specified millionths on the "plus" side of nominal block size and minus "zero" . . . absolutely nothing . . . undersize!

This complete elimination of the conventional minus tolerance gives you, the gage block user, three new and exclusive benefits. First, it provides positive assurance against receiving new blocks that are actually "worn" undersize during manufacture before they are ever used. Second, it gives you finer, more practical accuracy . . . with the sure knowledge that every Ellstrom block you buy will start wearing *toward* its nominal size rather than *away* from it. And third, it gives you a guaranteed minimum wear factor equivalent in millionths to the full minus tolerance specified as standard for all other makes of blocks!

Write for descriptive literature containing complete price information today!

ELLSTROM STANDARDS DIVISION

DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

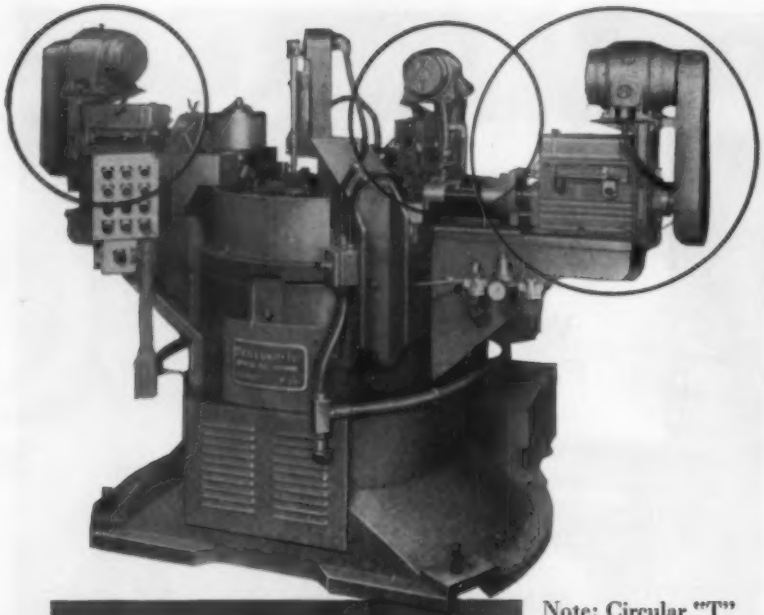
Ellstrom Gage Block Accuracy Guarantee

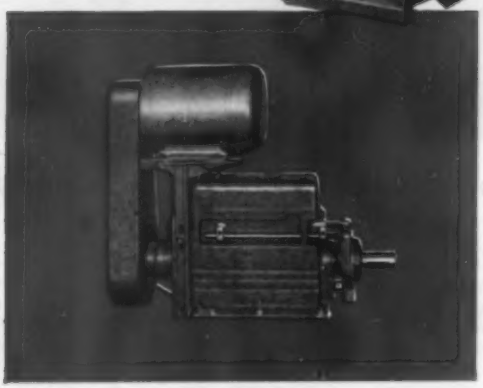
"W"—WORKING ACCURACY BLOCKS
Measured Length: +.000008"/−.000000"
Parallelism: .000004" Flatness: .000004"

"I"—INSPECTION ACCURACY BLOCKS
Measured Length: +.000004"/−.000000"
Parallelism: .000003" Flatness: .000003"

"L"—LABORATORY ACCURACY BLOCKS
Measured Length: +.000002"/−.000000"
Parallelism: .000001" Flatness: 000001"

Ellstrom—your best buy in gage blocks for shop and tool room use, inspection and laboratory applications. Available in 28 standard sets ranging from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories.





Note: Circular "T" slot on periphery of C. I. Base for wing and column adjustment.

DRILLUNIT STANDARD MACHINES MEET THE DEMANDS OF PROGRESS

This Drillunit machine is built of a standard base, brackets, columns, table, and the powerful Drillunits outlined in red. Because of this, Drillunit specials never grow old, reconvert at 60% to 80% less cost. Meticulously built by Drillunit of Detroit. Write today.

DRILLUNIT

DRILLUNIT INC., 3267 WIGHT STREET, DETROIT 7, MICH.

wherein by-passing avoids the hard knocks. We all know the intrinsic value of the many rough bumps we encounter throughout life.

From my many associates in industry—especially among toolmakers with whom I worked elbow to elbow along the bench—I was aware of a degree of sincerity and square-shooting which was indeed commendable. I may be disillusioned, but I cannot conceive of any one of them doing as our misguided friend Potts did in filling in an application blank deceptively. However, it's hard to tell what one will do in desperation.

Contrary to the opinion of others who think that the offender might have had a good reason for making such a false claim, I feel that in doing so he revealed a weakness which, encouraged by repetitive offenses, would engrave itself too deeply in his subconscious to overcome. Were he to be honest about his experience with his former employer and state the name correctly, then, parenthetically, give a brief on why he left, I feel certain that the truth would receive favorable consideration.

If the prospective employer representative wasn't big enough to accept the explanation and turned him down on account of it, Potts could take it that such an outfit wasn't worth working for. The man would be without a job for the time being but he would at least have his honor to compensate for a little inconvenience. I realize that a worker usually has his next pay to depend on, and cannot dilly-dally over scruples, but the truth will result in personal victory ultimately.

It may be said—and in truth has been—that "man has always sacrificed truth for his vanity, comfort, and advantage." Well, there are times when a man with a large family to provide for feels that he has to sacrifice truth in order to land a job. When he is on the fence, on one side of which are his family needs and on the other the possible rewards of an ideal, you cannot blame him for being pragmatic.

However we may reason the man's actions it still remains a question of what is right. Two wrongs do not make a right, but to cheat a good worker out of a job because of the wrongs of others seems to overshadow one fault with another. Here is a situation where two wrongs do make a right.

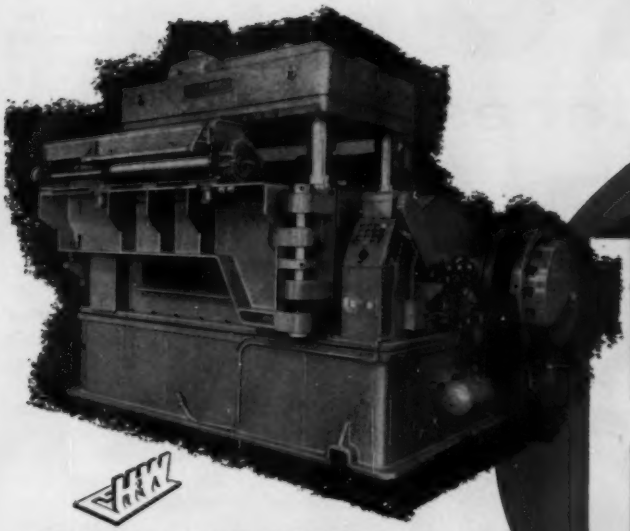
Assuming that Personnel was justified in having the man discharged over his deed, it still leaves his foreman holding the bag in that he has been belittled through not having been consulted before the man was

HENRY & WRIGHT

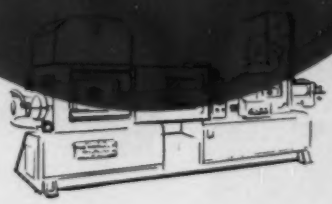
a great name in
metal stamping processes

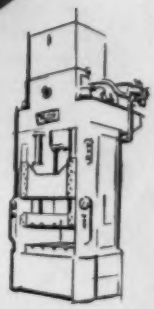
JOINS

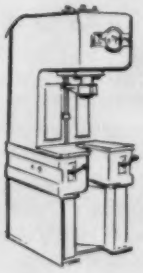
HPM

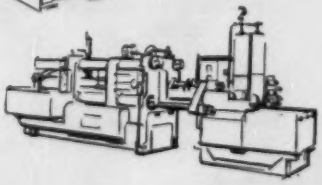


This is the new H & W Double Crank, 350 ton dieing machine which is designed to extend the economies of progressive metal stamping.









Here's a combination of two great names in the metalworking industry—each with a tradition for service to specialized fields—each with a reputation for quality and the finest in machine design.

Henry & Wright Dieing Machines offer better, faster production to more uniform specifications than ever before. The new double crank H & W's provide greater flexibility in stamping. Greater precision and longer die life result from the improved design of these versatile machines. The H & W you buy today has the benefit of years of experience behind it; the combined personnel of H-P-M and H & W, with background covering both the mechanical and hydraulic fields, offers the finest "one-two" punch in the industry for your complete stamping and forming requirements.

Make H-P-M your headquarters for presswork production equipment. Now, more than ever before, there's an H-P-M designed for your job.

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PROBLEM:

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SOLUTION:

B. Jahn delivered — "PRODUCTION PROVED" 8 station progressive die to perform marking, piercing, blanking, forming and cutoff in one press operation. 106 ton press produced 78 pieces per minute — 37,440 pieces per day! Another unusual die problem, routine at B. Jahn!

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B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

put to the skids. It would be justifiable action for the foreman to register a dignified complaint to his superior and insist that any further dismissals be taken with his approval. Ed could say to Harrison, if he felt that the man should be reinstated, "Either Potts comes back or you can look for another foreman." That would put some life into the situation and rectify a condition under which no foreman should have to endure.

Harrison Mitchell
Topeka, Kans

THERE IS ONLY one answer to the question "Should Personnel fire Potts"—it is yes. Morality recognizes two modes of conduct, right and wrong. Morality is just another word for honesty. Personnel cannot afford to turn a blind eye to serious wrongdoing, just because the culprit in this case is a good operator. When wrongdoing amounts to downright fraud, calculated false pretenses, it must not in any circumstances be condoned. Personnel is taking the proper course in deciding to fire the shifty Potts for making a statement, which he knew to be false, in his application for employment.

People like Potts are a danger to society; in a public works they are a positive menace to foremen and workmates alike. They can never be trusted and they can't be adequately watched. Catching a thief is child's play to watching a liar. At the same time, it seems a pity that Personnel did not, or could not move sooner in the matter. If Ed had Potts almost broken in to the work, he would seem to have been some time

"You'll have to finish bawling me out tomorrow, Boss! There goes the whistle!"

Hartford Special Multi-operation Indexing Machine equipped with four Skinner Power Chuck Fixtures

Production increased... costs slashed with Skinner Power Chuck Fixtures

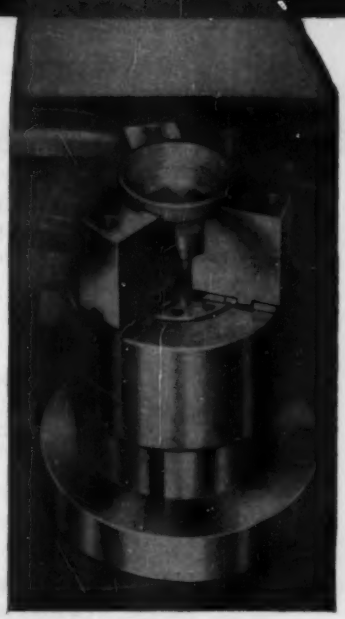
Four Skinner Power Chuck Fixtures mounted on an index table recently helped Hartford Special Machinery Company develop a low-cost, high-production machine for a customer that assured top quality at a lower part cost.

In this application, each Power Chuck Fixture holds a work piece and is indexed to three working stations for machining.

The operator has only seven seconds to unload and load, yet can keep up the pace all day long, thanks largely to the effortless releasing and gripping of the air-powered fixtures.

Skinner Power Chuck Fixtures are compact, but versatile enough to hold up to 15 sizes of the customer's work pieces, if need be. At the same time, they can be used to grip a wide variety of other work for drilling, machining, or assembly operations.

See how you, too, can profit from the accuracy, speed and strength of Skinner Power Chuck Fixtures. Send for Catalog No. 68P, which gives the details of all Skinner Chucks and Fixtures. Write Dept. 100.



Non-rotating Skinner Power Chuck Fixtures are ideal for holding work on drilling and milling machines, for assembly operations and for other bench and machine installations.

They're operated by air for fast, effortless loading and unloading. The compact units are available in several sizes, with either two or three adjustable or non-adjustable jaws.

Skinner Power Chuck Fixtures are available through leading Industrial Distributors everywhere.

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ESTABLISHED 1887

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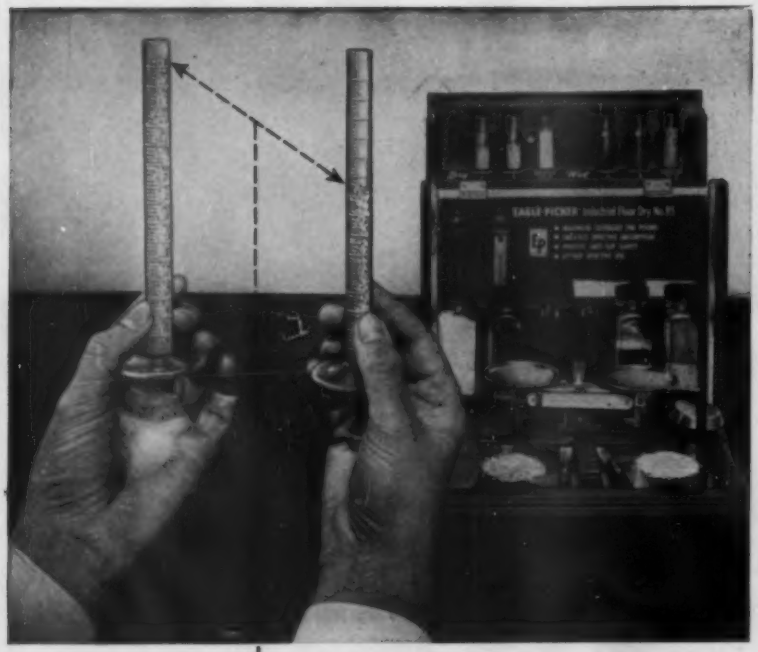

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with the company before Personnel felt obliged to remove him from the strength. Ed may feel he has a legitimate grouse there, but not legitimate enough to save Potts from the consequences of his folly in obtaining employment by cooking his reference in his letter of application.

Personnel has, of course, frequently to take men temporarily on trust, in order to satisfy the urgent needs of shop foremen. In most cases their trust is justified by results and everyone is happy. In the case of Potts, their trust has been abused and Ed and Personnel are alike unhappy, but not for the same reason. Probably if Personnel had held its hand till all the necessary information about Potts had been obtained, he might have been snapped up elsewhere. Ed, as likely as not, would then have "slated" Personnel for fumbling and losing him a much needed man. As I see it, Personnel took a reasonable chance, in the circumstances, and engaged Potts, with a view to helping Ed, who should be sport enough to see it that way.

I cannot believe that Ed really feels Personnel should commit a wrong, in a mistaken effort to water down a previous, inexcusable wrong by Potts. I fully agree with Personnel that Potts has shown himself to be wholly unreliable. The decision to fire him is unquestionably the right one, very much in the interests of Ed and his squad. Ed says "There's nothing wrong with Potts." Others may be pardoned for feeling there's nothing wrong with him except that he is a liar and a cheat. That is a very big something—something that could work havoc in Ed's department, and unlikely to be anything but a bad influence. In short, he's a fake. If Potts had a good case, there was no need for him to suppress his previous employer's name.

We all know there are unsatisfactory employers, just as surely as there are unsatisfactory and unreasonable employees. Methinks Potts had some skeleton hidden in his previous shop and in an effort to keep it hidden, he murdered the truth. In this age of tolerance, few companies give a rank bad report on a departing employee. If he has been a 'bad egg' they heave a sigh of relief when they heave him out. They are glad to be rid of him and usually let him down lightly. Other factors which enjoin caution in turfing out the undesirables are the power of the trade unions to make trouble and the law of libel.

An ingenious way out was adopted

(Continued on page 274)

HOW TO INSURE YOUR COSTLY DIES . . .

DON'T buy "bargain-price" special die sets!

When you need a special die set it is usually for an expensive die . . . one that you really should protect.

The few dollars extra you may pay for a "Detroit-built" special are the cheapest insurance you can have that your costly die will get maximum protection.

Believe us—there is a lot more to a good special die set than some steel plate and a few pins and bushings.

The protection your costly dies get from Detroit-built die sets is not accidental. It is built into every die set we make—standard or special—and we've been doing it for 30 years.

Sure, you can buy cheaper die sets, but they can be awfully expensive, too.

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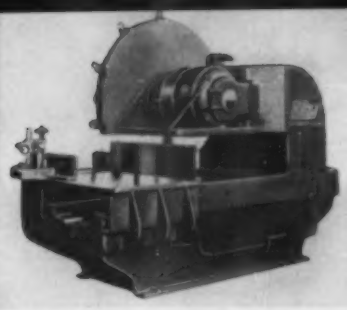
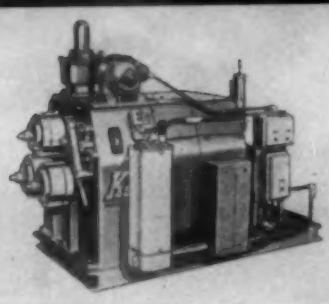
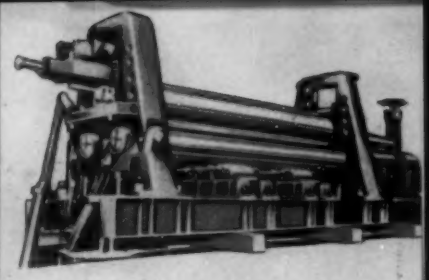


KLING FRICTION SAWS. "On 80 lb. rails we get from 800 to 1200 cuts per day."



KLING ANGLE BENDING ROLLS. "True Diameters...larger capacity, faster production"



KLING PLATE BENDING ROLL (PYRAMID TYPE). "Our experience with Kling proves that the Kling Pyramid Roll is easy to operate."

RIGHT out of the horse's mouth!

As relayed to us by production men from coast to coast! These are just samples—why not hear the whole story!

KLING SHEARS
"Now getting 16 hours work from an 8 hour shift."

KLING COMBINATIONS
"Does the work of half dozen machines . . . works two shifts in one!"

KLING FRICTION SAWS
"Could not handle our volume of structural cutting with one machine of any other kind presently on the market."

KLING PLATE ROLLS
"Plate speeds up to 30 feet per minute achieved."

KLING UNIVERSAL PUNCHES
"Does more accurate work at less cost . . . replaced two other make *machines."*

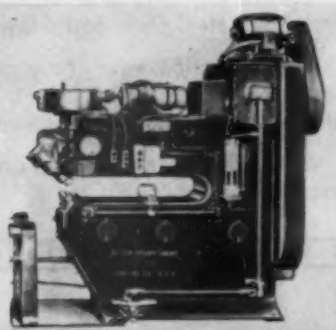
KLING PUNCHES
"Much more versatile machine, increased punching capacity."

KLING ANGLE ROLLS
"Truer diameter . . . larger capacity . . . faster production."

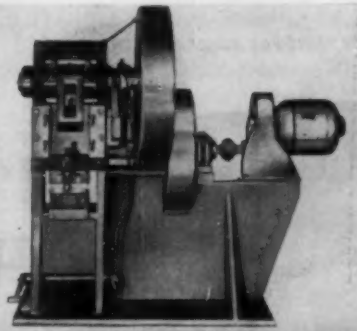
KLING MILL-ALLS
"Cut up to 1000% faster with exceptional ease—steel, aluminum, etc."

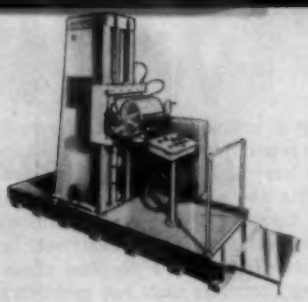
KLING COMBINATIONS. "Versatility makes them ideal for short runs, too!"

KLING ROTARY SHEARS. "6 sizes and various attachments enabled us to get a shear machine custom built for our needs."



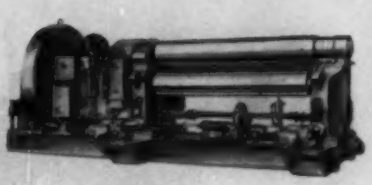
KLING GUILLOTINE SHEARS. "Does the job faster...neater; safety features liked by men."





KLING MILL-ALL. "Cuts faster with a finish that is better than most commercially-milled finishes."

KLING POWER BAR BENDERS. "15 bends a minute for 1¼ inch round is easy..."



KLING PLATE BENDING ROLL (PINCH TYPE). "Work is better controlled. Flats are held to a minimum."

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Workhorses

Speak the language Production Men Love to Hear

The men who operate Kling Machines get the performance facts straight from the Workhorses' mouths. They're relaying these facts to us... and they're the kind of facts any production man would love to hear... so we're reproducing a few typical samples on these pages... in the hope they'll whet your appetite for more. They will add up to...

Better Work... Faster Work... Easier Work Lower Costs

Ask the Men Who Know KLING BEST

You'll find KLING machines in "the Best of Companies"... and the production men in these companies are Kling's best friends. They know Kling performance first hand... they have the facts right out of these Workhorses' mouths! Why not ask us to send you the names of Kling users near you... see a Kling Workhorse in action... you'll hear the language every production man loves to hear! And mail the coupon now... for Bulletins on any or all of these Kling Workhorse machines.

You'll find Kling Workhorses in "the Best of Companies."

Bethlehem Steel... B&O Railroad

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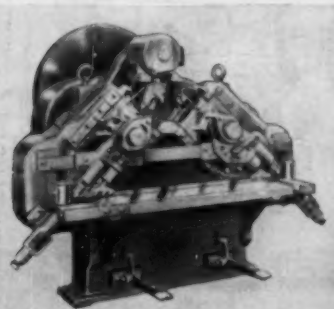
Westinghouse... Lockheed

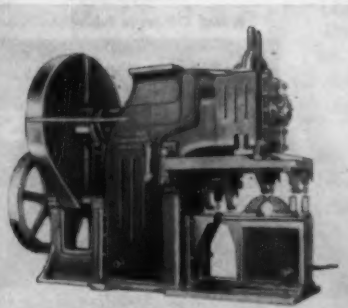
Allis Chalmers... Reynolds Metals

Pearl Harbor Shipyard... etc.

KLING DOUBLE ANGLE SHEARS. "Saves 75% of Labor compared to our old method ...less burr, too."



KLING PUNCHES. "Our 2 have run 16 hours a day for 20 years."



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- ☐ Rotary Shears
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☐ Also, names of companies near me whom I can contact for on-the-job performance results.

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254

Get 22.6% more air per power dollar

Comparative tests show that DeVilbiss compressors deliver up to 22.6% more air per power dollar than most others. Low-friction design makes the big difference—(1) shorter piston stroke (2) slower piston travel (3) ball-bearing-mounted crankshaft (4) full-floating piston pins, and (5) metered oil feed to all bearings! These features not only bring savings in power, but lower maintenance and depreciation costs.

DeVilbiss compressors are available in single- or two-stage, upright or V-type models; ¼ through 15 hp. For full data, call your nearby DeVilbiss supplier.

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by a colleague who was asked for a report on a one time employee. A very brief and terse reply ended with the sentence "He has ability—I think." Ed would be supremely foolish if he asked Harrison to reverse Personnel's decision about firing Potts. He does not seem to have much appetite for that venture, from which we may conclude he really agrees with Personnel, on principle, but is somewhat concerned about his dignity. If I am right in that assumption, Ed badly tarnished his dignity when he tried to excuse Potts by saying "After all, he just left out one name and substituted another." Could hypocrisy go further?

I am in complete agreement with Al's observations on the danger to the company in retaining the services of Potts and people of that ilk. We've all "had some" in our executive capacity. A classical example of the folly of faking, on the part of an otherwise reliable gage maker, was uncovered recently. The greater part of this man's work was thread-grinding large gages, six to twenty-one inches diameter, to A.P.I. specification. Readers familiar with this specification will be painfully aware of the meager tolerances laid down, notably for master gages. They will also be aware of the importance of the customers who place those gage orders, and of the highly organized system of customer control and inspection, prior to acceptance.

A complaint was received that a large master gage was found, on receipt, to be 0.0013" under permissible diameter size. It had been duly inspected and accepted as within tolerance by the customer's inspector. Management was astounded; nothing like that had ever happened before. Arrangements to prevent such had been confidently regarded

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A TYPICAL APPLICATION

Finish bore, turn o. d., groove, and chamfer zinc die-cast pulley.

Rate of Production: 190 pieces per hour.

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2. Self contained hydraulic unit, separate from machine, for easy maintenance and elimination of heat problems.
3. Standard commercial hydraulic components throughout.
4. Nickel-iron, one piece ribbed base with integral fixture mounting pad and chip disposal basin.
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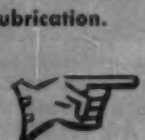
FIND HOW THE 30-012 FITS YOUR REQUIREMENTS. WRITE FOR LITERATURE.



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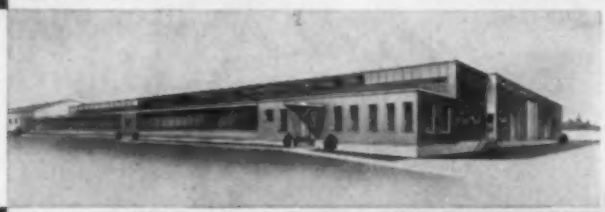

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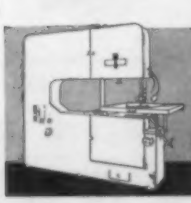

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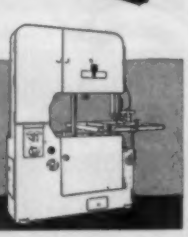


SAWING MACHINERY SPECIALISTS

as foolproof. Months later, the explanation leaked out. The gage-maker knew the gage was low on diameter size. He also knew the routine of the customer's inspector. The shops were heated by hot air blown at floor level. A large gage laid on the floor near to a heater "grew" a thou' and held its size long enough to get a certificate.

Customer's inspectors are sometimes pressed for time, and if a given supplier has a long record for the excellence of his product, it is possible for a "Potts" to put one over the inspector, but only one, if the powers that be know their job.

C Mackinnon
Lanarkshire, Scotland

A FALSIFIED employment application is an application for trouble. Although the employee was hired and trained a month after he put in his employment application, and the irregularity on his application was not discovered sooner, the fact remains that he did commit a fraudulent act in falsifying his application, and should be discharged.

Although the newly hired employee's present record with the company may be good, that has nothing to do with the case of his falsified employment application. That's in line with the company's policy that all new hires are checked carefully because the management wants only reliable and dependable people. A company is justified in not wanting unreliable employees on its payroll, and as a management prerogative, it has the right to select employees.

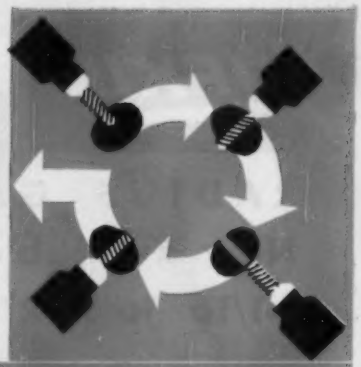
The case under discussion boils down to this: the falsification here may have been a slight error of omission, or a mere "puffing" of references on the application to make the applicant look good. But that was the applicant's way of looking at it, and a demonstration of his untrustworthiness. However, the company has followed a definite employment procedure, as it has done for all new hires, of sending a form questionnaire to previous employers listed on the application. The purpose of the employment form was to enable the company to make a judgment based on the facts submitted as to the applicant's qualifications as a prospective employee. It was his falsification which prevented the company from ascertaining this information. To sustain the foreman's request not to fire the man would, in effect, modify the company's exclusive and sole control over the hiring process, and there

Automate with . . .

Bedford

INDICATING GAGE . . . DRILL HEADS . . . CHUCK JAWS . . . PADS . .

COST CUTTING PRODUCTION TOOLS!



GAGES . . . ELIMINATES REJECTS . . . "SCRAP RUNS"!

PINPOINTS QUALITY CONTROL OF MACHINE PARTS AT SOURCE.

BEDFORD'S Indicating Gage meets the most exacting requirements:—

IT'S FAST! . . . more inspection at less cost!

SAVES ON SPACE . . . kept in tool or gage crib . . . issued for any specific job.

RUGGEDLY CONSTRUCTED, long life under normal shop conditions!

ACCURATE . . . checks gears, shafts, internal ring grooves, undercuts, etc.

Bedford Gear Universal Indicating Gage

SUPER PRECISION SERIES 1000

(Patent Pending)

WEIGHT — 25 lbs.

DRILL HEADS . . . MORE OPERATIONS PER DOLLAR!

MEET TODAY'S DEMAND FOR PRODUCTION SPEED-UP!

A positive drill head for semi or fully automatic operations, quickly interlocked with other units or equipment for automation.

Adaptable to multiple drilling and reaming.

Versatile . . . it drills . . . reams . . . taps . . . counterbores . . . centers . . . countersinks.

It can be used for end or hollow milling . . . tube flaring . . . tube facing . . deburring . . . boring . . chamfering.

BASE OR END MOUNTING.
ACCURATE DEPTH CONTROL

Bedford Gear Automatic Drilling Unit

SERIES 2000 SUPER PRECISION (Patented)

CHUCK JAWS . . PADS . . ELIMINATE SOFT JAW BORING!

BEDFORD Chuck Jaws can be adapted to any universal, air or hand chuck up to 16".

BEDFORD Chuck Jaws will accept hard or soft collet pads.

BEDFORD Chuck Jaws with their individual eccentric adjustment are easily positioned for rapid truing of the pads.

Bedford Gear Chuck Jaws . . . Pads

SERIES 3000

A TIME-SAVING METHOD FOR NEW JOB "SET-UPS".

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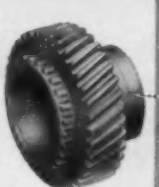
Since 1947 BEDFORD has been supplying custom-made gears and engineering design service to the aircraft and other industries demanding utmost precision and accuracy.

CONSULT BEDFORD'S professional engineering staff for gear design research and estimates.



Actual demonstration showing how easily these flexible BEDFORD tools adapt themselves to metalworking production problems.

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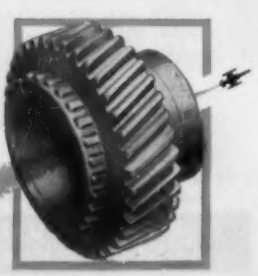
Bedford Gear

AND MACHINE PRODUCTS, INC.
Bedford, Ohio

CUSTOM MADE PRECISION GEARS SINCE 1947



LUFKIN

RADIUS GAGES Now Available for 1-1/16" to 2" RADII

Convenience and Adaptability Have Made Lufkin the First Choice in Radius Gages

1. Determines radius of inside corner and if sides are 90°.

2. Determines radius of outside corner and if sides are 90°.

3. Determines convex radius near projection that prevents use of gage as in views 2 and 5.

4. Checks any concave radius that is ½ or less of circle.

5. Checks ½ of a circumference.

This style radius gage, preferred by toolmakers, diemakers, patternmakers, inspectors, layout men and others, is now available in a complete range of sizes up to 2".

With a design pioneered and developed by Lufkin, each gage is a separate unit with five different gaging applications for use on both concave and convex radii. The gaging surfaces have smooth, accurately machined edges, and the sides of the blade have a polished, natural metal finish.

Available in sets as listed below or by individual gage. Sets are packaged in durable folding cases of heavy red vinyl, fitted with pockets for each edge.

No. 77A	16 gages 1/32 to 17/64 by 64ths
No. 77AX	17 gages 1/64 to 17/64 by 64ths and No. 20 Holder
No. 77B	8 gages 9/32 to ½ by 32nds
No. 77C	24 gages (Sets 77A and 77B Combined)
No. 77CX	25 gages (Sets 77AX and 77B Combined)
No. 77D	16 gages 1/32 to ½ by 32nds
No. 77E	8 gages 9/16 to 1 by 16ths
No. 77F	8 gages 1⅛ to 2 by 8ths
No. 77G	16 gages 1 1/16 to 2 by 16ths

BETTER MEASURE WITH LUFKIN
TAPES • RULES • PRECISION TOOLS

473

THE LUFKIN RULE CO., Saginaw, Michigan

IT PAYS TO USE YOUR INDUSTRIAL DISTRIBUTOR
. . . He can simplify your purchasing

would be no purpose in the procedure which the company has adopted in fulfilling its responsibilities in hiring employees in requiring applications be filed. I agree with the personnel department that the new man should be discharged for cause, even though Personnel couldn't get the information on his references sooner. How could Personnel get verification of the references when the applicant deliberately omitted putting down his last employer as a reference because he had trouble with him? He filled in a fake name, and Personnel found out—and the end result should be discharge.

I know that I wouldn't want a man working for me who deliberately attempted to bluff out a thing like an employment application. He probably would try the same thing if he made a mistake in his work and gambled on turning in a job with a hidden flaw.

The argument is advanced that the company has a right to fire employees for falsifying applications, but it should do so within a reasonable time. Although I do not agree that any time limit should be set for ascertaining the veracity of reference information on employment applications, I believe that Personnel should have checked the references by phone instead of by mail. Checking references by phone is a simple and quick way of getting answers. And through direct conversation you can find out a lot more about applicants. A lot of mail inquiries to former employers are answered slowly, if at all. And when production pressures are on, you can't wait

"Watch that Mr. Carruthers . . . he's a perfect devil when he passes a fast-moving swivel chair!"

Everybody knows that
National Tool Company
makes rotary gear cutters—

But did you know
we make Erhardt-style
taper finishing reamers . . .

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one special tool or a complete tooling program.

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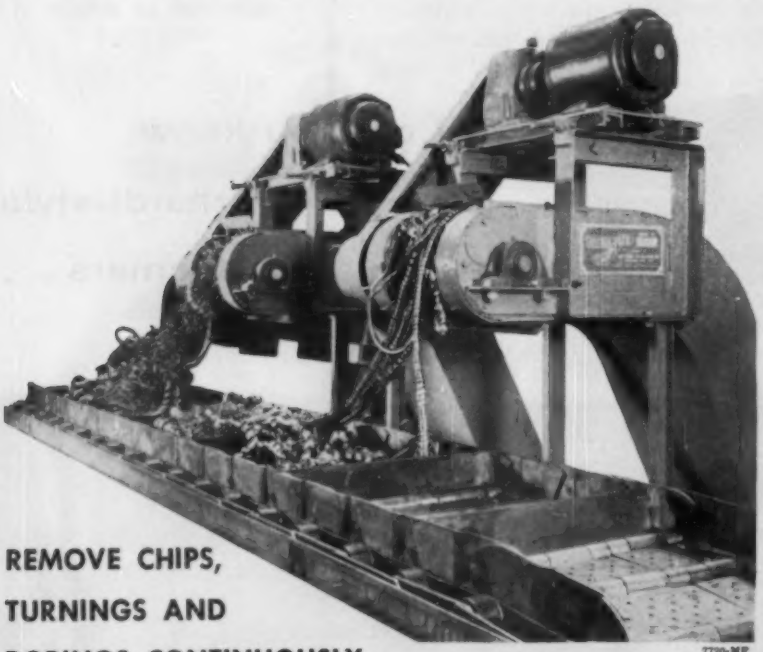
That's right! The May-Fran CHIP-TOTE permits the continuous operation of machine tools by eliminating down-time for scrap removal . . . skilled workers stay on the job . . . production increases by as much as 20%! Versatile CHIP-TOTE conveyors are available in a wide range of sizes to serve practically any type or size of machine tool. Conveyor speed is adjusted to meet the scrap removal needs of the machine.



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REMOVE CHIPS, TURNINGS AND BORINGS CONTINUOUSLY AND AUTOMATICALLY WITH A MAY-FRAN CHIP-TOTE

Write today for your copy of Bulletin MF-640

MAY-FRAN

ENGINEERING, INC. 1677 Clarkstone Rd., Cleveland 12, Ohio

for a written answer. With more freedom to ask and modify questions to suit the particular situation, you can get a much better check by phone. Written requests to references for information allow the former employer to ponder. On the phone, they are likely to answer spontaneously, and give more reliable information.

Perhaps in the case under discussion a phone call instead of a written request to the referenced former employer would have brought the irregularity to light much sooner and avoided the needless time and effort that the foreman spent in breaking in the new man.

Harry Kaufman
Philadelphia, Penna

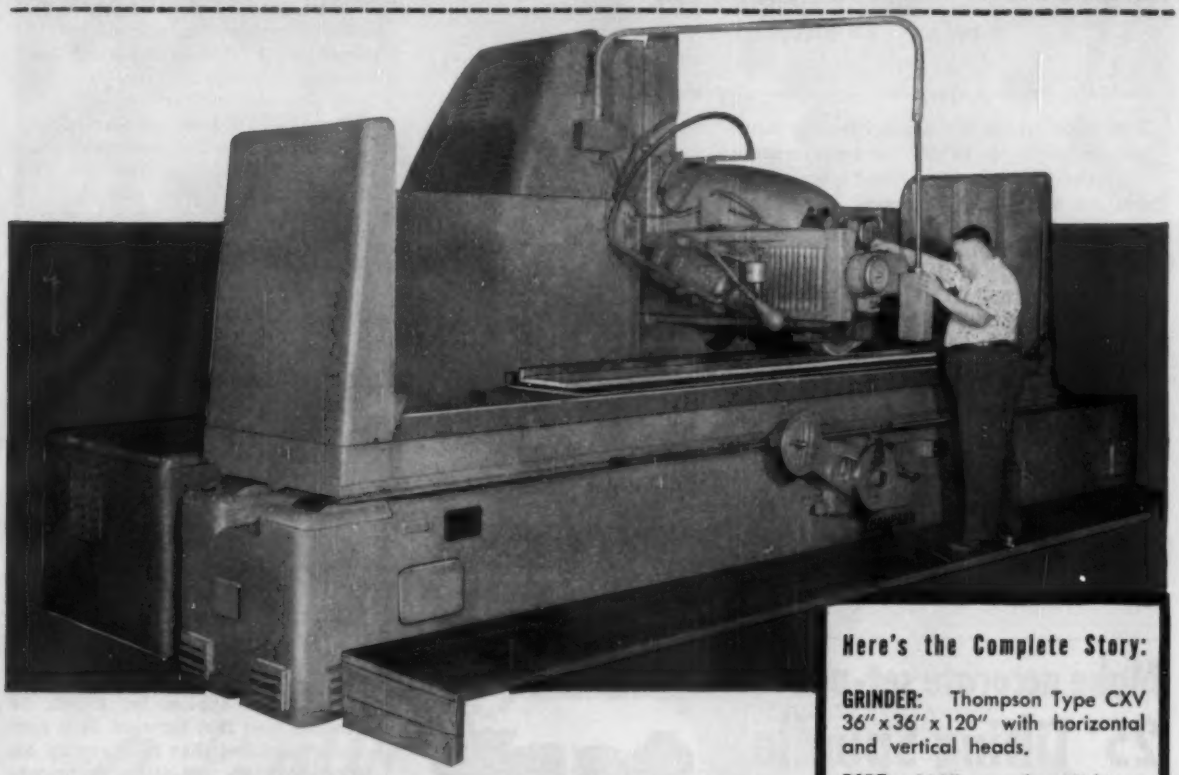
IT SEEMS TO ME that the title of the latest Al-Ed problem is very apt, insofar as Ed is concerned. It looks like our friend is sticking his neck out when he tangles with Personnel on a ruling that was expressly designed to relieve his hiring headaches. The fact that his man Potts turned out well is just one of those exceptions that go to show that personnel-application forms do not take into account the workings of the human mind. The incident in his previous employment record that Potts tried to cover up might have been satisfactorily explained if he had been honest and stated the facts.

I am willing to gamble that there is no man alive who can look back on his past employment record and honestly say that his progress from job to job was smooth and unruffled. Somewhere along the line he would have to admit occasions when he turned in jobs that he wasn't particularly proud of. Of course it is human nature to put one's best foot forward when applying for a new job, but Personnel—like the cop in the television series—is looking for the facts, just the facts.

At the present time, with many machine shops working on government contracts, investigation of an employee's previous record has, of necessity, become an important part of plant safety. In the days of not-so-long-ago it was considered sufficient to make a few telephone calls to check on a prospective employee's story. Now trained investigators do a more thorough and painstaking job, which of course, takes time. A man like Potts, in this hypothetical case, might get through the initial screening, but inevitably his "error" of concealment is bound to catch up with him. If the penalty for mak-

When large parts must be ground to total tolerances of .0005" or less . . . .

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM SOLVE THE PROBLEM!



Machine ways up to 118" for The Michigan Tool Company's Roto-Flo Spline Rollers must be ground to .0005" total tolerance. Heat distortion, caused by hydraulic heat, became a critical problem in achieving this tolerance.

During the three months of operation since the installation of Thompson's new Hydra-Cool Hydraulic System*, these long ways are being ground to consistent .0003"-.0004" total tolerances. Heat distortion is eliminated. Scrap loss is reduced to zero. Grinding time is greatly reduced.

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM MAY BE THE ECONOMICAL SOLUTION TO YOUR GRINDING PROBLEM. WRITE TODAY FOR FULL PARTICULARS.

Hydra-Cool also offers you these exclusive advantages:

- Heat damage to hydraulic seals, valves, controls and pump is eliminated.
- Break down of additive-type hydraulic oils is prevented—sludge will not form in the Hydra-Cool System.
- Lengthy warm-up periods are eliminated.
- Power costs are greatly reduced.

Hydra-Cool is standard on all Thompson surface grinders 40 inches and up in work length AT NO EXTRA COST.

Here's the Complete Story:

GRINDER: Thompson Type CXV 36" x 36" x 120" with horizontal and vertical heads.

PART: 118" way for Michigan Tool Co. Roto-Flo Spline Roller.

RATE OF TABLE TRAVEL: 100 ft./Min.

MATERIAL REMOVED: .065".

METAL: Flame hardened Ductile Iron.

WHEEL: 20x4x12 H Grade.

SCRAP LOSS: None.

GRINDING TIME: 3-4 hrs.

THE THOMPSON GRINDER CO., Springfield, Ohio, U. S. A.

*Pat. Applied For.

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This 25-TON Hannifin Straightening Press Sells For

$4,455 FULLY EQUIPPED AS SHOWN

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The ideal press for straightening heat-treated parts up to 60" between centers. Exclusive Hannifin Sensitive Pressure Control for speed and accuracy. Ram block, two table blocks and center-type fixture complete with rails included.

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Hannifin offers longer tables and rails, roller-type fixtures, larger or smaller capacities (5 to 150 tons)—all at prices that are easily justified by savings on the job. Bring us your straightening problems.

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Make accurate set-ups *faster* with this 25° Tilting Spindle

The STERLING Model "G-2" Universal Tool and Cutter Grinder provides this extra feature plus complete versatility and more capacity than comparable machines at *lower cost.*

Swing 10¾" over table, 27" between centers, 18" table travel with 8¼" cross feed. For complete details and specifications write for FREE Bulletin "G-2".

Grind 90° to 140° Included Angle on *ALL DRILLS*, ⅛" to 2½"

No collets or chucks makes set-ups easy. Clearance gauge insures accurate, positive clearance angle. True conical grinding produces full clearance from center to outside. Write for FREE Bulletin "DV-1".

McDONOUGH MFG. CO.

1526 GALLOWAY • EAU CLAIRE, WISC.

ing inaccurate statements on an application form is clearly stated—and most of them have that statement—then it is difficult to see where Ed has a leg to stand on in raising hell with Personnel.

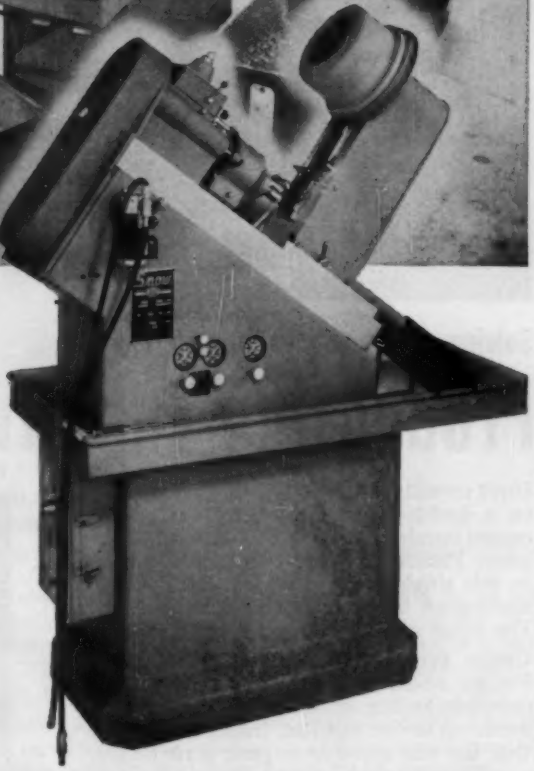
I admit Ed has an excuse for griping about having to break in a new man just when Potts was beginning to show promise of being useful, but every foreman has run across the same or a similar situation and learned to accept it.

If, instead of raising hell with Personnel, Ed had approached the situation calmly and reasonably, recognizing the obvious fact that his man Potts was in error and regretted his mistake, there might be a chance to earn him a "reprieve" by sitting down with Personnel and explaining the situation. After all, both Ed and the Personnel man are working for the same company and should have the company's interest at heart. If there is no question of plant security involved and the rule can be relaxed with benefit to all concerned so much the better, a little cooperation works wonders when the circumstances are right, but in this case the old adage still applies, "You can catch more flies with molasses than with vinegar."

Robert S Alexander
Glastonbury, Conn

WHEN A PERSON tries to sell himself, as when he applies for a job, he puts his best foot forward. It is generally assumed that he plays up his good qualities and attempts to conceal his weak points. Hence an employer judges an applicant on the picture that is presented to him plus

Automatic NUT TAPPING MACHINES



This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
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DRILL PRESS TAP HEADS

SNOW

MANUFACTURING COMPANY

435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

Solving problems with VULCAN Tool Steels:

Production run tripled

Until recently, a run of 200,000 switch boxes on a double-acting draw press was an accepted standard at Steel City Electric Company, Pittsburgh. The compound die used in this single-stroke blanking and drawing application is subjected to severe abrasion. The boxes come off the press hot.

Under pressure for greater production, Vulcan Alidie tool steel was used for the complete tooling set-up. 688,000 boxes were produced in one tool run. Inspection proved that the run could have gone even longer.

Is there room for this kind of improvement in your production schedule? Talk to your Vulcan representative—your specialist in *forged* tool steels. *Vulcan Crucible Steel Division, H. K. Porter Company, Inc. Aliquippa, Pa. Offices and warehouses in principal cities.*

Jesse Cassanita, tool and die supervisor, Steel City Electric Company, calls the performance of Vulcan Alidie Tool Steel in this test "a near miracle."

H. K. PORTER COMPANY, INC.

VULCAN CRUCIBLE STEEL DIVISION

that which experience has taught him. He knows that no one is perfect and therefore considers that every worker has imperfections.

If a prospective employee reveals that he has had difficulty with a former boss, that is to his advantage. First, because he is exemplifying a good quality, that of honesty. Secondly, in revealing this weakness he is merely citing something that is already known to every personnel interviewer, the fact that there is a little bad in the best of us. Indeed he is making it easy for the potential employer to discover what he knows he will eventually find out.

If an applicant takes the unpredictable turn and resorts to dishonesty, then he throws the whole pattern of interviewing out of kilter. Big things start from little things. Because of a nail—a war was lost. If a man deliberately lies, in writing, there is no telling how far he will go. He may not intend to extend his wrong-doings but in finding that he has gotten away with a small item he would find it very easy to try again. In doing so he might go just a step farther and so on ad infinitum, repeating and enlarging his area of misdemeanors.

It is difficult enough to contend with the unintentional errors that people make in this life without inviting trouble and hiring someone whose dishonesty is obvious. The advice that "honesty is the best policy" has not come down through the ages without good reason.

Joseph McLaughlin
Rockaway Beach, NY

LET THE KID CLEAN UP

Should skilled mechanics and tool and diemakers be relieved of the chore of cleaning up chips and dirt? Should apprentices be expected to do any part of clean-up jobs?

WITHOUT AN extensive survey there is no way to estimate how many present-day shops, employing machinists and tool and die makers, still use old-fashioned methods of housekeeping. A safe guess would be that most, if not all, are trying to keep pace with progress using new and better systems in all phases of shop work.

In the case of the small shop the combined efforts of the few should extend to the over-all picture of skills plus good housekeeping. As the shop grows and starts operating at top speed, when more employees

cut it with stop

1881 CAPEWELL

power hack saw blades

THE USER: Edgcomb Steel Company, Philadelphia, Pennsylvania
THE MATERIAL: High Speed Steel Billets
THE JOB: Maintaining precision-true hack sawing
THE PROBLEM: Uneven cuts and excessive blade breakage
THE ANSWER: Capewell Safetech Power Hack Saw Blades
THE RESULT: Power hack sawing now a routine operation—no more production headaches.

Edgcomb Steel Company chose Capewell's shatterproof Safetech blade for this long, heavy job because they could get more cuts per blade, quickly and economically under heavy feed, while providing complete operator safety. Other Capewell power hack saw blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

76 CAPEWELL ANNIVERSARY

SOLD ONLY THROUGH CAPEWELL DISTRIBUTORS who provide: complete inventory . . . engineering assistance . . . delivery when you need it.

THE CAPEWELL MANUFACTURING COMPANY
Hartford 2, Connecticut

Please send complete details on Capewell Power Hack Saw Blades to:

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COMPANY_____

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CITY_____ ZONE_____ STATE_____

In an iceberg or in a J. K. Smit Diamond Tool only a fraction shows above the surface.

Everyone knows about the unseen portion of an arctic iceberg. Many do not realize the unseen factors that lie beneath the surface of a J. K. Smit Diamond Tool, such as . . . our constant research to find still better methods of manufacturing Diamond Tools, the unquestioned integrity of our company since 1888, the manufacturing skills that have been learned and passed on through all those years, and quality control of manufacture for tool duplication.

All these hidden assets count much toward maintaining our position as a leader in the industry today.

When *your* next job specifies a diamond tool for any purpose contact J. K. Smit. Our field representatives are trained and qualified to assist you with any standard or special application.

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY

are added and the production rate is stepped up, the division of labor becomes an important factor. The man who must stop between jobs to sweep up is not producing all he can, and the man who limps off after stumbling over the litter he had no time to clear away is temporarily an economic liability.

Modern management recognizes the economic necessity to providing unskilled labor for the menial tasks of manufacturing. At the point of diminishing return, when interrupted operations for cleaning up become too costly, the logical solution is full-time employment of unskilled labor. Thus, the full potential of the technical knowledge and educational background of today's apprentice may be utilized, and seasoned workers maintain their worth.

In the final analysis, who gets the clean-up duties is purely a matter of dollars and cents.

E S Mulligan
Westbury, NY

CLEANING the machines is one of those disliked chores that is always with us. In production departments every effort is made to keep the tools cutting. Rapid traverse, automatic cycles, quick-change tooling and dual fixtures are employed to reduce the interval when the tool is not cutting. As a result great quantities of chips and waste are produced. They are recognized as one of the products of the production process and provision is made for their removal. The shop is laid out with arrangements for convenient handling of a steady flow of chips. People and equipment are assigned to this work and there is little question about the responsibility.

In toolrooms that have rules covering the cleaning of machines any

"Have you seen that new kid?"
"I sent him after a sky hook!"

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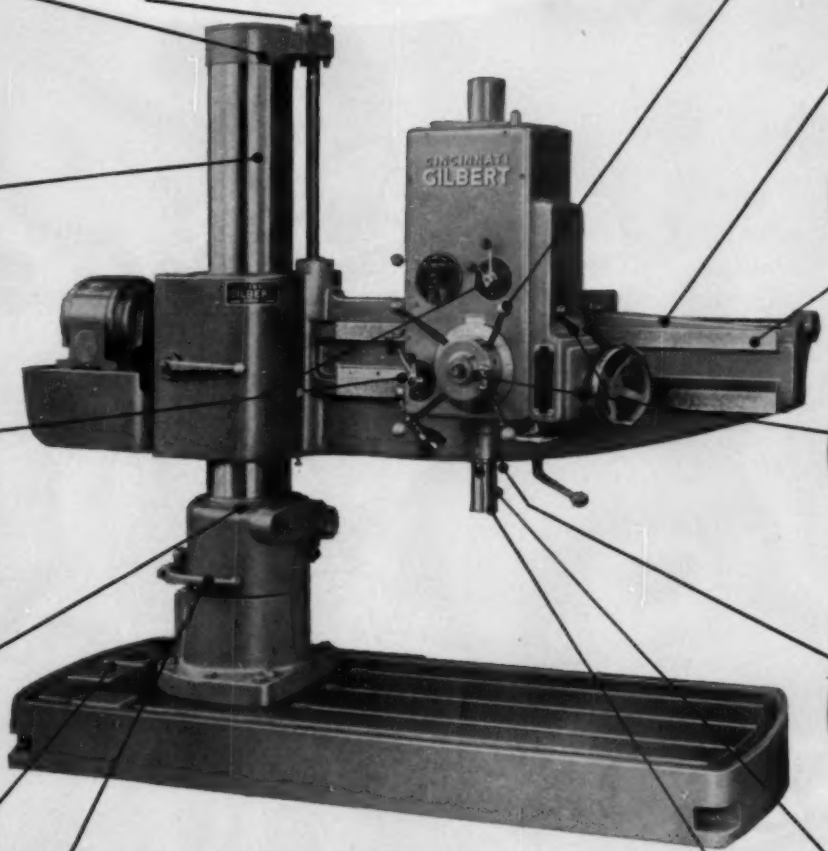
When you order a Cincinnati Gilbert radial, you get more new features per dollar than any other radial can offer. And every feature is designed to give you maximum return on your investment—in performance, productivity, and dependability.



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Hardened column available

Direct-reading speed and feed shifters; gears counterbalanced for easy shifting

Adjustable ball bearing rollers on hardened ring for maintained rigidity

Long heel on heavy base provides 360° stability

Powerful, accurate electric column clamp available

Four-lever turnstile cuts machine handling time

Balanced arm resists torsion, compression, tension forces

Head rides on anti-friction bearings; clamps three surfaces

When disengaging positive feed clutch, spindle won't drop

Full spindle support near tool; runout is less than .001"

Hardened tang slot is an exclusive Gilbert feature

You can always see the spindle; get extra use of spindle travel

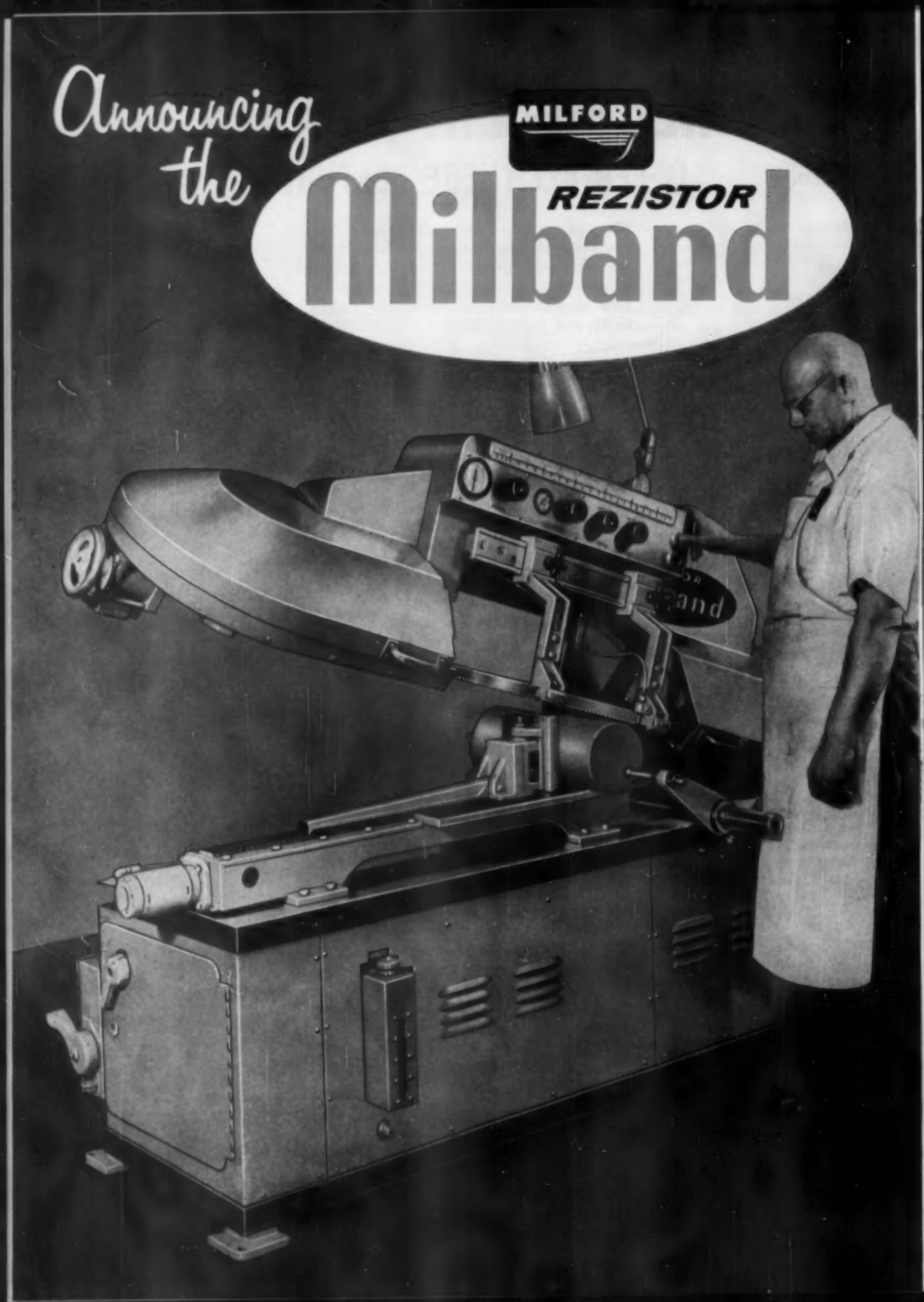
And don't overlook these additional features:

- wide range of spindle speeds for efficient tool performance;
- hardened gears throughout the machine;
- standard or special tap leads available;
- modern styling which reduces housekeeping, convinces customers that your shop is up-to-date;

Write or call for Bulletin 349.

those who buy Gilbert buy Gilbert again

THE CINCINNATI GILBERT MACHINE TOOL CO.
3340 BEEKMAN STREET, CINCINNATI 23, OHIO


Announcing the
MILFORD
REZISTOR
Milband

...the NEW Band Saw Machine that Meets Modern Cut-Off Requirements

The all-new MILFORD REZISTOR MILBAND was specifically designed to do a job that no conventional band saw machine can handle . . . utilizing and delivering the full potential cutting capacity of the MILFORD REZISTOR High Speed Steel Band Saw Blade!

The MILBAND is a rugged, heavy-duty machine designed and built for the fast blade speed and heavy feeds of which the REZISTOR Band Saw Blade is capable. A very wide range of variable blade speeds (40 to 360 fpm) provides the right setting for every metal. New hydraulic blade feed automatically compensates for greater blade resistance when cutting larger cross sections. Optional automatic indexing bar feed attachment provides fully-automatic operation, insuring maximum output at lowest cost.

Ideal for high-output cut-off sawing—even where stainless steel, super metals and other tough-to-machine alloys are involved—this blade-and-machine team now brings you faster and more *accurate* cutting . . . and important savings in chip loss compared with conventional cut-off methods.

The MILBAND and MILFORD REZISTOR . . .

the Machine and Blade Team for High Speed Production.

WRITE NOW FOR COMPLETE INFORMATION

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THE HENRY G. THOMPSON & SON CO.

Saw Blade Specialists for Over 80 Years

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. . . at BOOTH 1545, NATIONAL METAL EXPOSITION, CHICAGO

Chain Belt Co. Installation. Tool index boards, left, quickly locate all tools. Employee record boards show all tools charged to each employee.

CHAIN BELT COMPANY OF MILWAUKEE REPORTS

"We couldn't get along without our McCaskey Tool Crib Control"

Twenty years of service for Chain Belt Company of Milwaukee has proved McCaskey Tool Crib Control is an indispensable part of any tool crib operation. Experience has shown that the small initial investment is often returned many times within the first year of use, and that annual savings can amount to thousands of dollars.

McCaskey tool accountability cabinets in Chain Belt Company tool crib.

Here are just a few ways McCaskey Tool Crib Control has saved money for Chain Belt Company and will save money for you:

(1) Keeps tool inventory in the crib at a minimum, reducing monthly purchases.

(2) Prevents accumulation of idle tools at machines or benches.

(3) Reduces tool breakage by identifying source of breakage.

(4) Reduces loss and misplacement.

(5) Eliminates slow crib service, reduces non-productive time of employees and machines.

And, the McCaskey System does all this and more without additional crib personnel. McCaskey Systems are completely flexible—there is a set-up for your plant regardless of size or products. Find out how you can cut your tool expense . . . mail the coupon today:

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of several plans are employed. In some shops each man is required to clean the machine after using it. This is a good plan for the small shop but it becomes an extravagant waste of toolmaker's time in the large shop. The toolmaker's time is valuable and the pay rates and overhead are constantly increasing. If a shop employs about 25 toolmakers, careful observation will disclose that at any time during the working day an average of one man is cleaning a machine. This is equivalent to having one toolmaker spending full time cleaning the machines. This of course is economically unsound. In this toolroom with about 25 men there will be about two apprentices. If the machine-cleaning chore is delegated to the two apprentices they will each spend about half their time cleaning. This arrangement is also uneconomical. The apprentices are there to learn the trade and produce simple parts while learning. The objective is to train them to be toolmakers in as short a time as possible.

The best procedure seems to be to have a man in the shop hired for the job of cleaning and oiling the machines. If this work does not require his full attention there are other duties he can perform. He can return un-used stock to the storage rack and supplies to the crib. He can deliver completed tools to the production departments and pick up tools which need repairs. If the man shows an aptitude for the work he can be trained to cut off stock for the toolmakers. This system is the one which is most conducive to good attitudes in the shop. Each employee is doing the job he was hired for and no one feels that he is doing someone else's work.

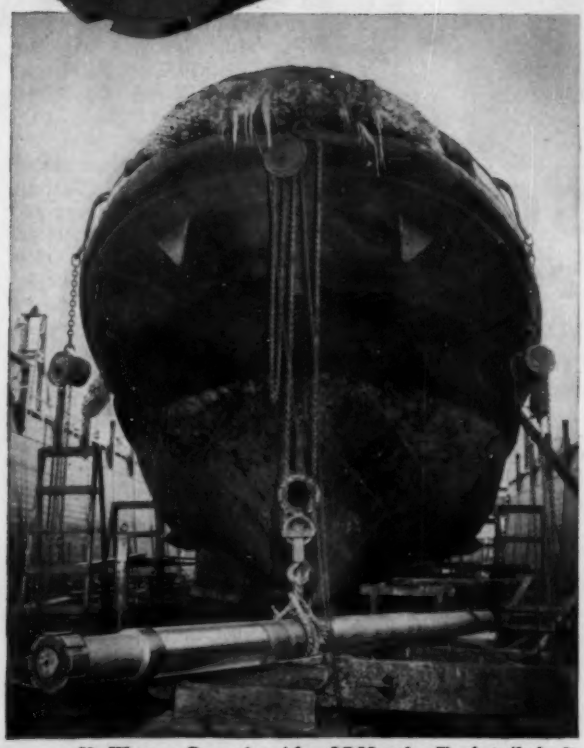
Clifford Molloy
New York, NY

"I'm not stopping for anything today, Gus. For once I'm going to finish a part before they change the specifications on it!"

HAYNES Alloys solve *tough* wear and corrosion problems

New Method

Eliminates maintenance on bearing area of shafts



No Wear or Corrosion After 17 Months. Tug's tail shaft is removed for inspection of HAYNES STELLITE alloy sleeves at the outboard bearing area. The sleeved surface still has a mirror-like finish.

After 17 months of grueling service in the sandy salt water of New York's harbor and surrounding waters, a tail shaft sleeved with a HAYNES wrought alloy at the outer bearing area showed only 0.015 in. wear. A bronze sleeve used in this same service wore over ¼ in. in 15 months.

This remarkable improvement in wear resistance was accomplished quickly and economically by the use of half sleeves made of HAYNES STELLITE alloy. Three sets of the half sleeves protected the bearing area of the shaft.

For more information on the many industrial applications for HAYNES STELLITE alloy half sleeves and bushings, ask for a copy of our free booklet. Write HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

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ALLOYS

HAYNES STELLITE COMPANY
Division of Union Carbide Corporation
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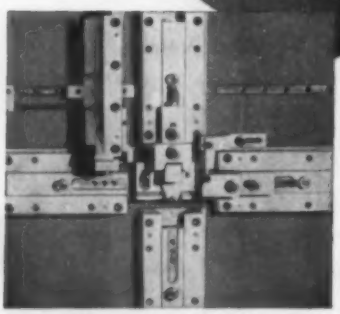
NEWEST

CONCEPT IN FORMING



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Our LATEST DEVELOPMENT—

Applying 4-Slide Forming Techniques To A Vertical Machine.

Designed For Rapid Tooling Set-Up And Ease Of Operation.

MACHINE SPECIFICATIONS #V-187

- Max. diam. wire—inches ..... .187
- Max. length of feed—standard 15"
- Max. length of feed—with change gears ..... 30"
- Max. width ribbon metal ..... 1¼"
- Stroke of forming slides ..... 2½"
- HP. required 2
- Machine speed—standard 30-120 RPM
- 4 and 20 ton Press Attachments available.

ADVANTAGES OF THE NILSON VERTIFORM

1. Greater Tool Accessibility
2. Unobstructed View Of Product Being Formed
3. Forming Slide Units Removable and Interchangeable
4. Less Floor Space Required
5. Operator Safety (Most Moving Parts Enclosed)
6. Automatic Oiling Of Entire Machine

Write To Our New Plant For VERTIFORM CATALOG

THE A. H. NILSON MACHINE CO. Bridgeport Ave., Shelton, Conn.

NILSON

NAMES IN THE NEWS...

Andrew W Rose, a vice president of Borg-Warner Corp, has been elected vice president and assistant to the president of the Byron Jackson Division. He has been serving as vice president and general manager of the Petro-Mechanics Research Division, B-W laboratory at North Hollywood, Calif.

James M Jaques has been appointed assistant sales manager of Nicholson File Co, Providence, R I. He was formerly metropolitan New York area manager.

Carl K Wolff has been appointed western regional sales manager of W S Shamban & Co, Culver City, Calif, manufacturer of Teflon and Kel-F products. He was formerly associated with Federal-Mogul-Bower Bearings, Inc, as product coordinator of the National Seal Division.

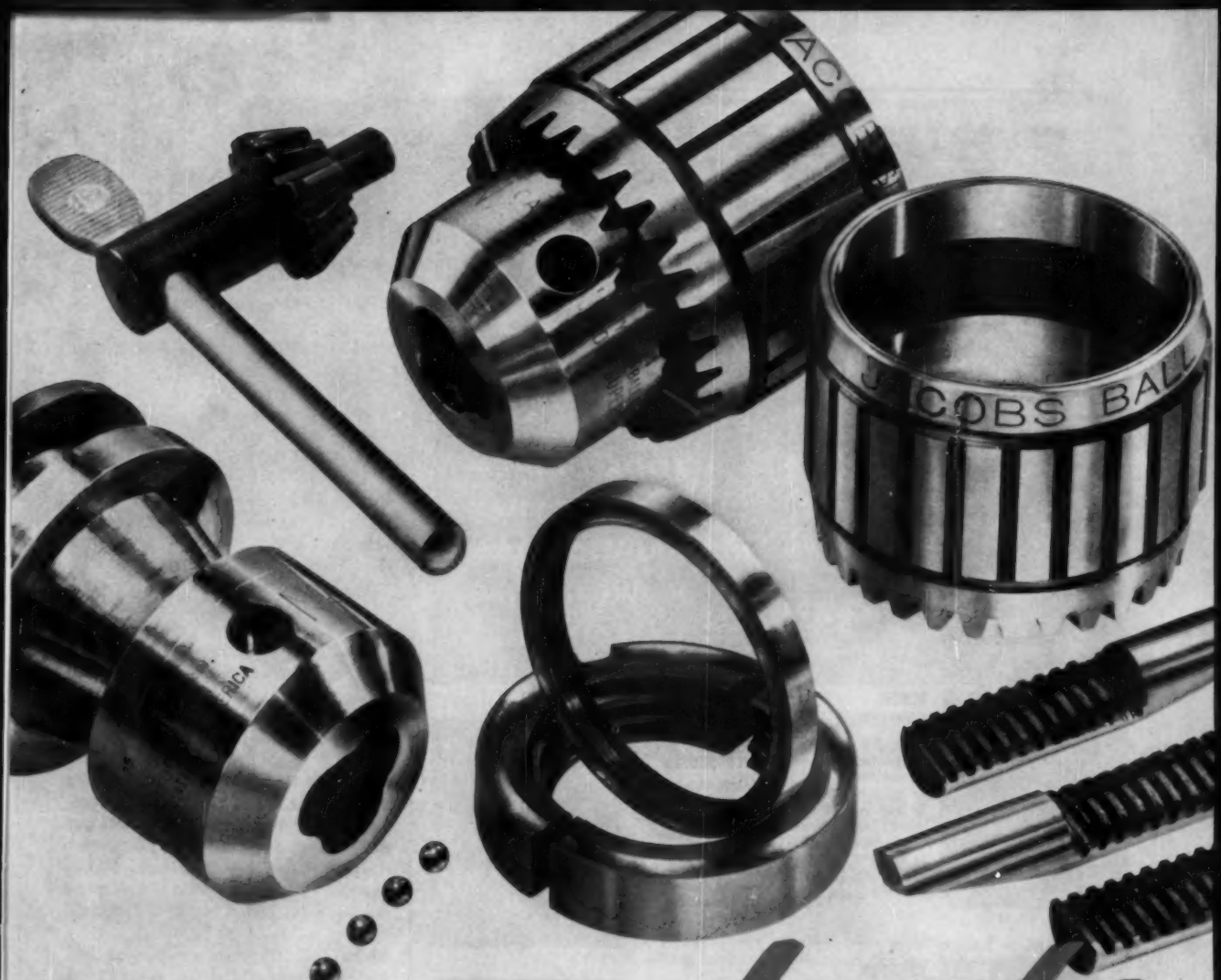
Edward M Grady has been named sales manager of mill products, Western Brass Mills Division of Olin Mathieson Chemical Corp. He moves up from the post of assistant to the vice president, sales.

Clifford J Sheehan, eastern sales manager of ALCOA's Die Casting Division, Garwood, NJ, has been re-elected president of the American Die Casting Institute for the 1958 term. **Clifford L Anthony,** works manager of the Hoover Co, North Canton, Ohio, will serve again as vice president.

M L McCartney has been named works manager for the distribution transformer department of Westinghouse Electric's Transformer Division at Sharon, Penna. Formerly superintendent of operations, he replaces **C E Hutchison,** recently named works manager for the company's new distribution transformer plant going up in Athens, Ga. **William S Perkins,** purchasing agent for the company's Small Motor Division at Lima, Ohio, has been appointed director of purchases for the general products group.

Lee F Weitzenkorn has been appointed assistant to the works manager of Armco Steel Corp's Baltimore Works. **John S White,** supervising metallurgist, succeeds Mr Weitzenkorn as works metallurgist.

Donald W MacLeod, a member of the staff of the Abrasives Division of



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Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

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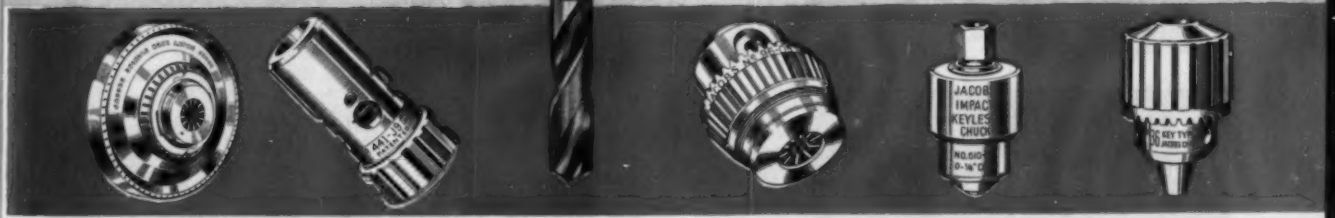
West Hartford, Connecticut



The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

PRECISION PRODUCTION PROBLEMS?

Here's help from Bausch & Lomb in TOOL DESIGN INSPECTION FABRICATION MEASURING TESTING

NEW! ALIGNMENT INTERFEROMETER

Accurately measures small changes in angle over a range of 30 seconds of arc (±15 seconds). Easy direct scale readings to 0.2 seconds (0.000006").

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Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001" with optional micrometer stage.

STEREO-MICROSCOPES

Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.

CONTOUR MEASURING PROJECTOR

Shows magnified silhouettes or surface views. Simple operation, highest precision measurements: to 0.0001", linear; to 1 minute of arc, angular.

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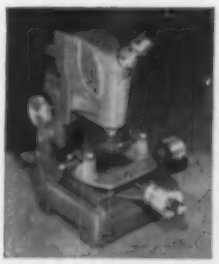
Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Microscope Bodies, Micrometer Discs, Wide Field Tubes, Brinell Microscopes, Shop Microscopes.



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SINCE 1853

Elgin National Watch Co, has been named sales supervisor in charge of

William R Harkness has been promoted to sales manager of the Seaboard Pacific Division of Associated Spring Corp, Gardena, Calif. He was formerly sales supervisor.

Robert L Grunewald has been appointed manager of manufacturing for General Electric Co's Gas Turbine Dept.

William H Balentine has been promoted from assistant manager to manager of the Instrument Division of Thomas A Edison Industries, West Orange, NJ. He succeeds **Henry G Riter IV,** appointed executive vice president of Edison Industries, a unit of McGraw-Edison.

Roy Norton has been promoted from assistant to director of engineering for the Long Manufacturing Division of Borg-Warner Corp. **A H Schmal,** sales manager of special products, has been appointed general sales manager of the Division.

Arthur H Branstad has been named manager of sheet and plate production and sales activities for Kaiser Aluminum & Chemical Corp's Industrial Division. **William J Edmunds, Jr,** has been appointed manager of extrusions and forgings.

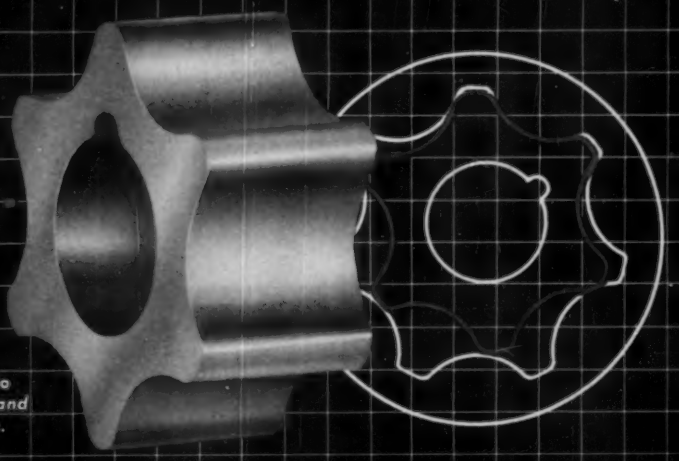
Richard K Dickson, chief metallurgist of Trent Tube Co, East Troy, Wis, subsidiary of Crucible Steel, has been named general manager of the company's new plant at Fullerton, Calif.

Roland L Guerin, Jr, formerly associated with the Aircraft Industries Association's west coast offices, has been named director of special projects for the Hufford Corp, El Segundo, Calif, manufacturer of heavy roll forming machines.

George A Chandler has been appointed manager and **Melvin L Henry** production manager at the New Haven, Conn, plant of Western Brass Mills Division of Olin Mathieson Chemical Corp.

John J Flaherty has been named assistant to the general manager of Atomics International, a division of North American Aviation, Inc, headquartered at Canoga Park, Calif. Mr Flaherty recently resigned as manager of the Chicago Operations Office of the Atomic Energy Commission.

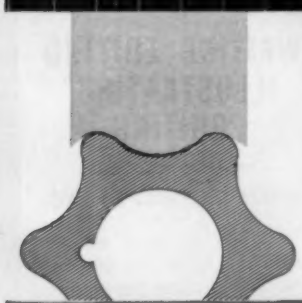
hoglund contour dressing...



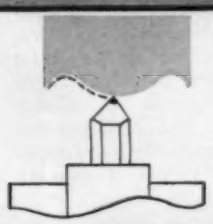
Six faces ground to .0002" tolerance and 9 microinch finish.

Closer tolerances in pump assembly increase rotor life and efficiency, improve slippage characteristics.

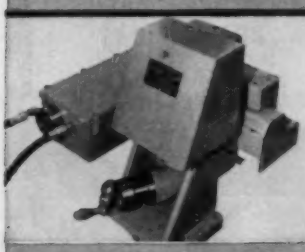
boosts impeller grinding rates — improves pump performance



13 stacked impellers are automatically indexed and the form ground in 6 separate positions.



After each impeller stack is ground, wheel is dressed at uniform peripheral speed with diamond normal to surface.



Hoglund Model 38A Dresser features computed master contour template, 10 to 1 inclined plane cam reduction, diamond cooling during dressing.

This impeller is typical of the countless form grinding applications where the accuracy initiated by Hoglund Contour Dressers enables both product and production improvement.

A Hoglund Model 38A Dresser, installed on a 12x40 surface grinder helped boost production 40%, improved tolerances, and lowered surface finish from 20 to 9 microinches. Combined high accuracy and high production are assured because: a) all Hoglund templates and ratio cams are individually computed to the job; b) only with the simplicity and ingenuity of inclined planes can you sustain accuracy and automaticity.

Over 120 different types of Hoglund Contour Wheel Dressers are now in service — enabling "tenth tolerance" contouring of intricate forms heretofore impossible to grind. They're adaptable to all types of grinders.

If you are grinding simple or intricate forms, you will want the whole Hoglund story in Hoglund's new technical brochure. Let Hoglund engineers recommend a suitable solution to your problem.

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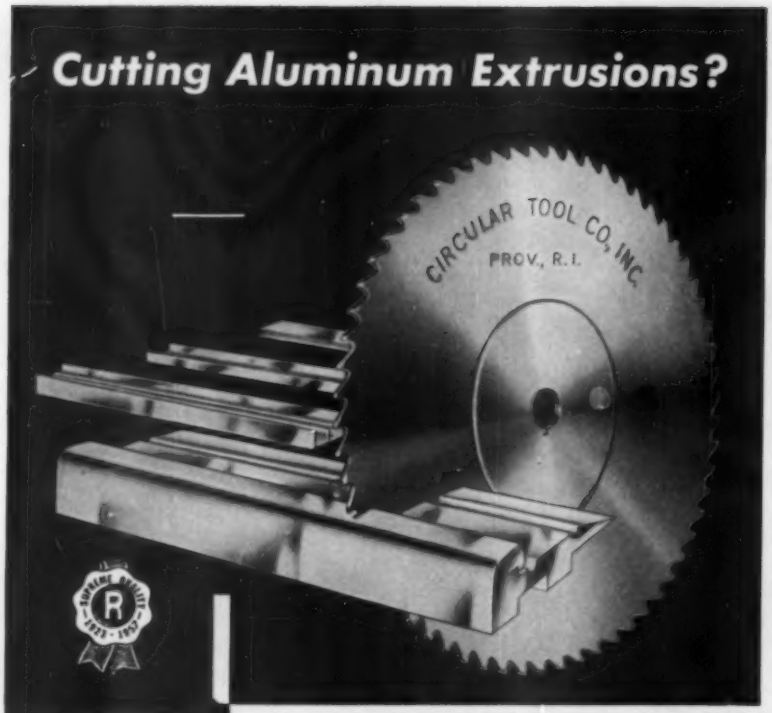
Cutting Aluminum Extrusions?



Specially designed for cutting aluminum extrusions, this saw is proving exceptionally efficient. Ask Circle R representatives about its performance and for our know-how in cutting this important metal . . . we'll be glad to tell you!

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PROCEDURE for methods improvement: Pick an operation to be improved. Put down in writing what happens—the details. Challenge each detail in order. Where a chance for improvement appears, develop the better method. Apply it on the job.

BAUSH "SPECIAL" 3-WAY UNIT

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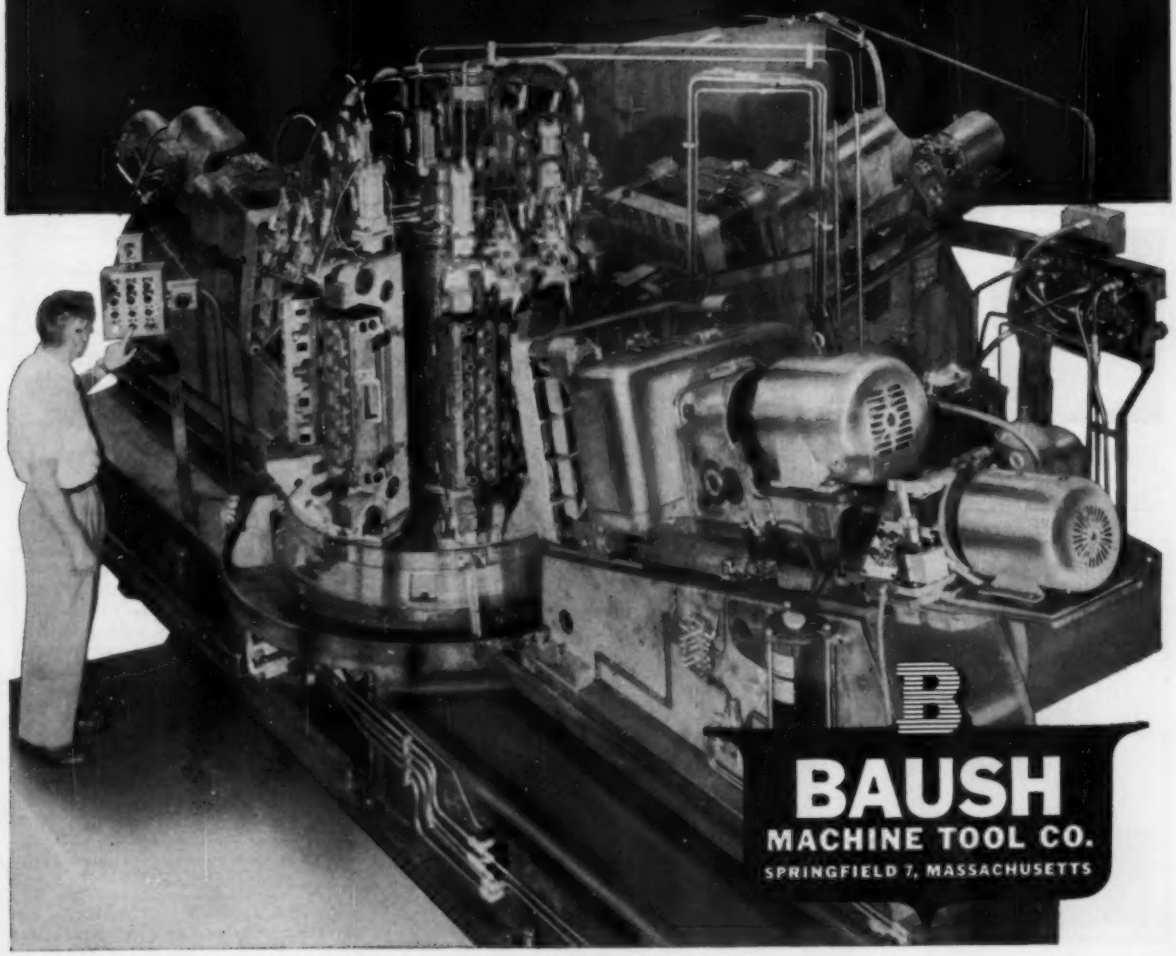
It is one of several different machines we have designed and are producing to complete a cylinder-head production line for a leading automotive manufacturer . . . resulting from past proven performance of other Baush units designed for specific jobs in this plant.

If you are thinking of AUTOMATION — THINK OF BAUSH. Our experience is yours — we'll gladly help with your machine tool problems.

SPECIFICATIONS:

Unit has 50" diameter, 4-station semi-automatic rotary table with a 2-position, 4-station fixture, plus full Trabon Lubrication. Three (3) 35° Vertical Angular Model "S" Mechanical Leadscrew units, each having a 4-spindle fixed center head, are mounted on a welded steel center base. Chip conveyor runs through machine.

Part is manually loaded into fixture and hydraulically located and clamped. Fixtures are equipped with guide bushing for tools and bars register in holding units when part is in machining position.



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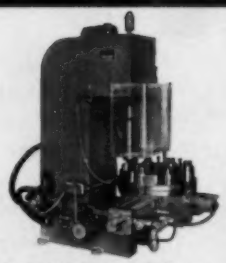
INCREASE PRODUCTION 50%



IT'S BEEN DONE—for a "big 3" auto company. Tooling shown increased production on press assembly of steering knuckles from 1200 to 1800 pieces per hour—with added operator safety. **COMPLETE SET-UP**—#1405 Air Index Table, #C-300 5½ Ton Press, controls and fixtures were furnished by Air-Hydraulics, Inc. An electrical circuit synchronizes press and table for fully automatic operation on standard line pressures. Operator places pieces on fixture outside guard • Parts are indexed into position and pressed together • Assembly is removed automatically and chuted into container. Constant pressure throughout ram stroke has eliminated previous trouble caused by variations in stock thickness and other factors.

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NO BACKLASH, SKIPS, OVERRUNS

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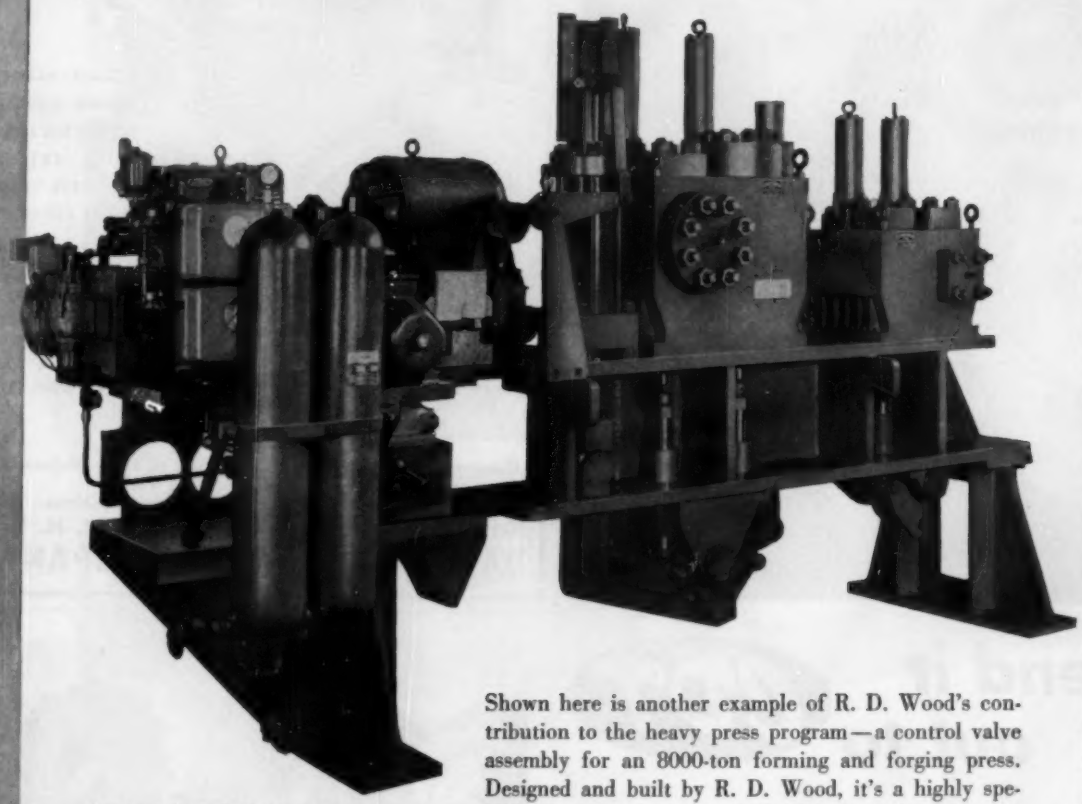
Big help in heavy press program



Remote electro-hydraulic servo control valve assembly. Length is 14 feet; height 9 feet.

Shown here is another example of R. D. Wood's contribution to the heavy press program—a control valve assembly for an 8000-ton forming and forging press. Designed and built by R. D. Wood, it's a highly specialized type. It indicates R. D. Wood's ability to handle the most difficult valve engineering and manufacture.

Other standard R. D. Wood high-pressure hydraulic valves include stop, operating, check, relief, and safety types. Since 1803, the name R. D. Wood has stood for superior products. Write for details on R. D. Wood high pressure hydraulic valves for every purpose.

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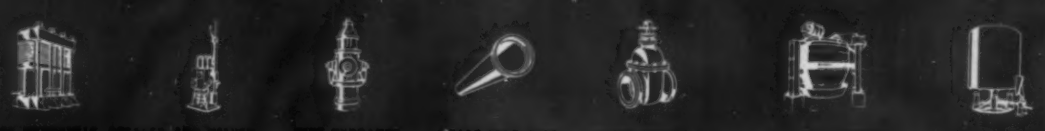
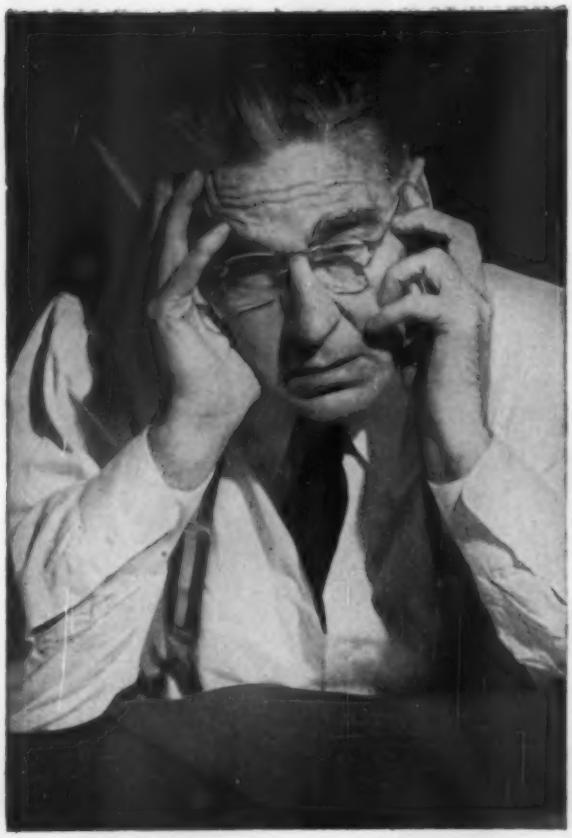
Representatives in Principal Cities





send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

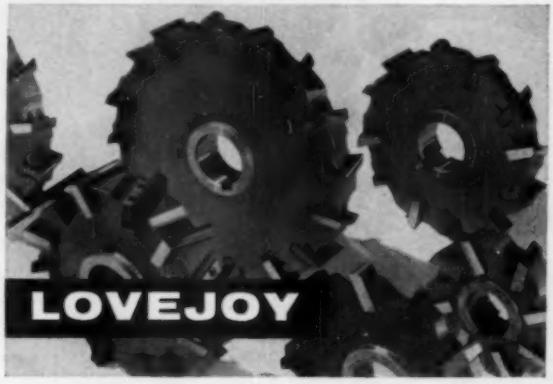
Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

KEYSEATING
The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

Great simplicity and ease of operation of Davis Keyseater, assure the user of accurate, time saving work.
Let our engineer study your keyseating problems.
403 EXCHANGE ST. • ROCHESTER, N. Y.
DAVIS KEYSEATER COMPANY



NEW Type "Z" Milling Cutters

Staggered Tooth Slotting Cutters

HSS Vasco Supreme Gashed Type Blades—Blades are serrated to allow radial adjustment

Wedge Lock—Wedge allows continuous axial adjustment

HSS Vasco Supreme Double Handed, Double Serrated Blades—Can be used in either right or left hand position. Serrations allow both axial and radial adjustment

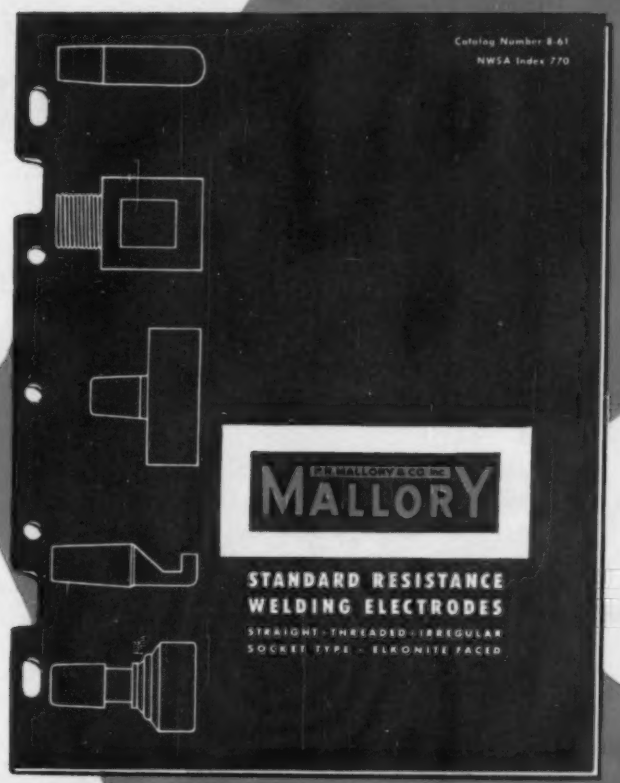
Double Set Screw Lock for Added Rigidity—A smaller double set screw lock is used for narrow widths and smaller diameters

Half Side and Interlocking Cutters—Extra Blade Length to accommodate all applications

Write for Catalog No. 35

LOVEJOY TOOL COMPANY, INC.
141 Main Street, Springfield, Vermont, U. S. A.

Let Mallory Be Your Guide to *Reduced Welding Costs*



* *Get your copy of this brand new Mallory catalog of Standard Resistance Welding Electrodes from your Mallory Distributor.*

Whenever your production plans call for resistance welding, take your pick from Mallory's broad range of *standard* electrodes—listed in this new Mallory catalog. Choosing from this extensive array of standard, in-stock sizes, shapes and types, can materially reduce your production costs by eliminating the need to purchase specially designed, custom made electrodes and fixtures.

Mallory's broad line of resistance welding electrodes are available in a choice of alloys having physical and mechanical properties exactly suited to welding virtually any combination of metals.

When planning your next production operation, you'll find it pays to check the Mallory line, first. Mallory distributors carry most of these standard shapes in stock for your convenience. Should you have special requirements, beyond even this broad line, Mallory's engineering staff will gladly assist in designing or adapting electrodes and assemblies to your specifications.

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P.R. MALLORY & CO. Inc.
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Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

Performance records PROVE CLAUSING COLCHESTER LATHES' Superior Construction . . . Greater Value

The statement of Florida Machine Products on facing page is typical of customer experience — users everywhere report Clausing geared-head lathes lead their field in every comparison of capacity, performance and value. Here are the reasons behind Clausing's acclaimed superiority.

They're bigger in capacity than other lathes in their class. Have larger spindles, larger thru-hole capacity, larger bearings for heavier work. (See chart at right.) The geared-head drive is powered by one or two speed motor thru multiple V-belts.

Have heavy-duty construction throughout. Beds are 50% steel 50% iron with elliptical cross ribbing — ways are induction hardened and precision ground. Gears in head and quick-change box run in bath of oil — gear shafts are multi-splined. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile hammered steel forgings — note size. Note, too, the heavy-duty construction of tailstock and double-walled apron.

Built for precision performance — to American standards of toolroom lathe accuracy. Have Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry. And each Clausing lathe passes rigid tolerance tests before it leaves the factory — the accuracy report accompanying each lathe is your assurance it will machine with dependable precision.

Each is an outstanding value. 13" cabinet base models, including motor and controls, start at $1952; 15" cabinet base at $2744; 17" at $4345. All are available in straight and gap bed models.

Clausing geared-head lathes are built in England by Europe's largest manufacturer of precision lathes — they are backed by the coast-to-coast sales and service organization of one of America's leading machine tool manufacturers . . . Clausing.

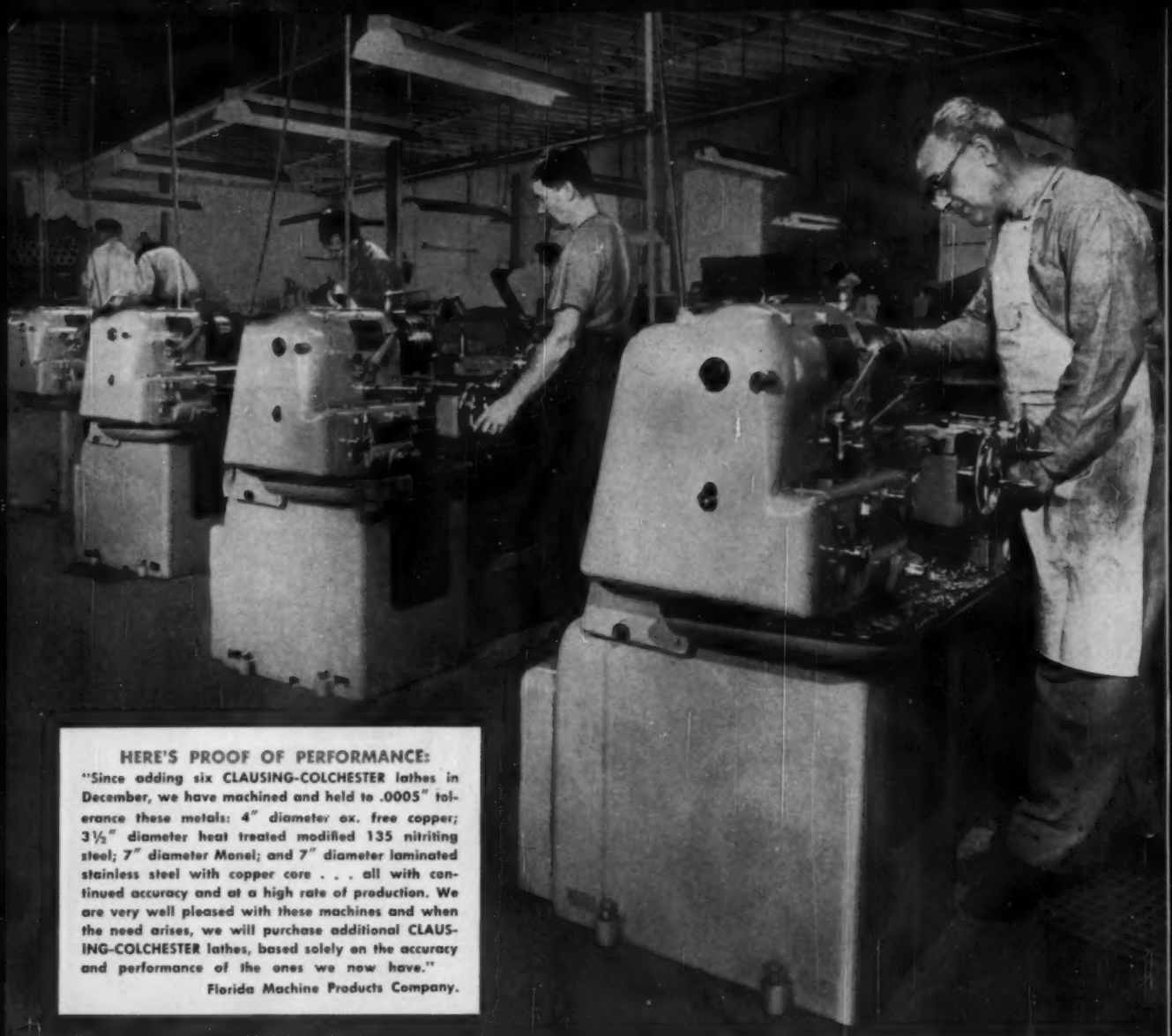
You owe it to yourself to investigate before investing in *any* lathe. See for yourself how much *more* you get with Clausing geared-head lathes.

Write for free LITERATURE

CLAUSING DIVISION ATLAS PRESS COMPANY

10-101 N. PITCHER ST. • KALAMAZOO, MICHIGAN

CLAUSING COLCHESTER GEARED-HEAD



HERE'S PROOF OF PERFORMANCE:

"Since adding six CLAUSING-COLCHESTER lathes in December, we have machined and held to .0005" tolerance these metals: 4" diameter ex. free copper; 3½" diameter heat treated modified 135 nitriting steel; 7" diameter Monel; and 7" diameter laminated stainless steel with copper core . . . all with continued accuracy and at a high rate of production. We are very well pleased with these machines and when the need arises, we will purchase additional CLAUSING-COLCHESTER lathes, based solely on the accuracy and performance of the ones we now have."

Florida Machine Products Company.

LATHE CAPACITIES

17" lathe: 54" and 78" centers, 28" swing in gap
15" lathe: 30" and 48" centers, 24" swing in gap
13" lathe: 24" and 36" centers, 18" swing in gap

SPINDLE CAPACITIES

Lathe	17"	15"	13"
Thru-Hole	3-1/16"	2-1/16"	1-9/16"
Nose Taper Key Drive	L-2	L-1	L-0

BEARINGS

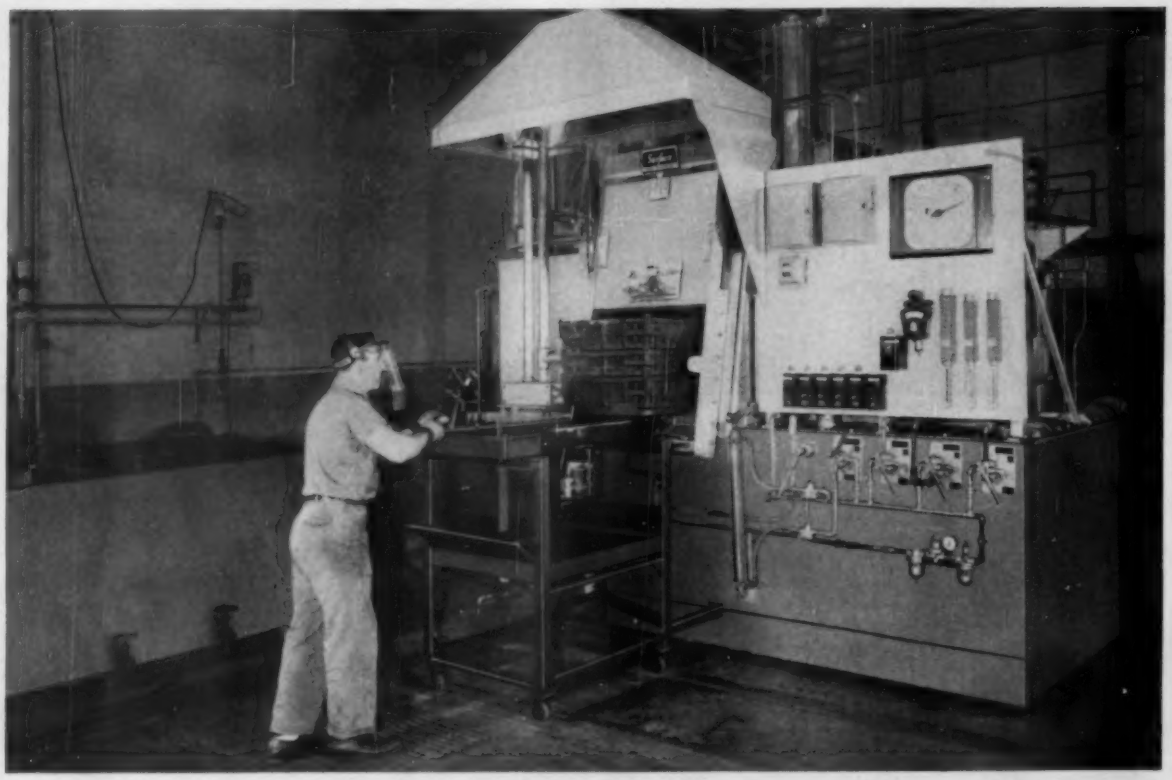
Lathe	17"	15"	13"
Front Spindle Bearing O.D.	7-1/2"	5-1/2"	4"
Rear Spindle Bearing O.D.	6"	4-3/8"	3-9/16"

15" lathe illustrated weighs 2250 lb. net. Price, $2919

SEE THEM AT THE NATIONAL METAL EXPOSITION, CHICAGO, ILLINOIS, NOVEMBER 4-8, BOOTH 1350

PRECISION LATHES *machine it...FASTER—BETTER!*

Allcase® furnace clips cost ½ on manicuring implements



One man and one furnace now match the former production of two men and two furnaces in this plant. Added to this gain are two others: greater versatility in processing, and finished work of uniformly high quality. The latter is especially important to this manufacturer of manicuring implements, because he offers a lifetime guarantee on many of his products.

The "hero" of this story is the Surface Allcase® furnace, which is used for hardening, carbonitriding, carburizing, and annealing. Controlled atmosphere is supplied by a Surface MRX® gas generator. Work handling and atmosphere control can be completely automatic, if you wish. Why don't you find out about this profitable furnace now?

Write for Bulletins SC-163 and SC-174.

Surface Combustion Corporation, 2365 Dorr St., Toledo 1, Ohio. In Canada: Surface Industrial Furnaces, Ltd., Toronto, Ontario.

wherever heat is used in industry

Surface

New Model D Single Dial CompAIRator. Available with instrument mounted gaging; or for remote connection to machining operations for in-process or post-process gaging.

New!

HIGH PERFORMANCE Air Gage Line

...the TAFT-PEIRCE Model D CompAIRator

Here's another big improvement in air gaging. The well-known CompAIRator has a completely new functional design that gives you 3 big advantages: — makes air gaging easier to read, easier to use and easier to trust!

EASY TO READ — Special visor and slanted face cuts glare and reduces parallax — speeds the gaging operation. Dial has full 180° linearity.

EASY TO SET UP AND USE — Zero and range setting knobs are within easy reach of the operator. Plus, compact chassis, and simplified dial and magnification changes. The Model D can be set and used at any angle, moved easily because it's light. Can be racked or modulized.

EASY TO TRUST — Yes, you can place full confidence in the new design because it uses the proven T-P Velocity-Venturi Circuit. Repeats readings without variation, has exceptional speed of response and is readily adaptable to many special uses, including wide tolerance gaging.

Modernize your gaging with this new CompAIRator. Or, ask a Taft-Peirce representative to demonstrate the new T-P CompAIRator — you'll be amazed at the performance.

New Model E. For the first time, a low-cost version of standard Taft-Peirce circuits so you can cut costs by using air gaging for many more inspection operations. Has external tolerance hands and compact cabinet. Same accuracy, same dependability — the biggest air gage value on the market.

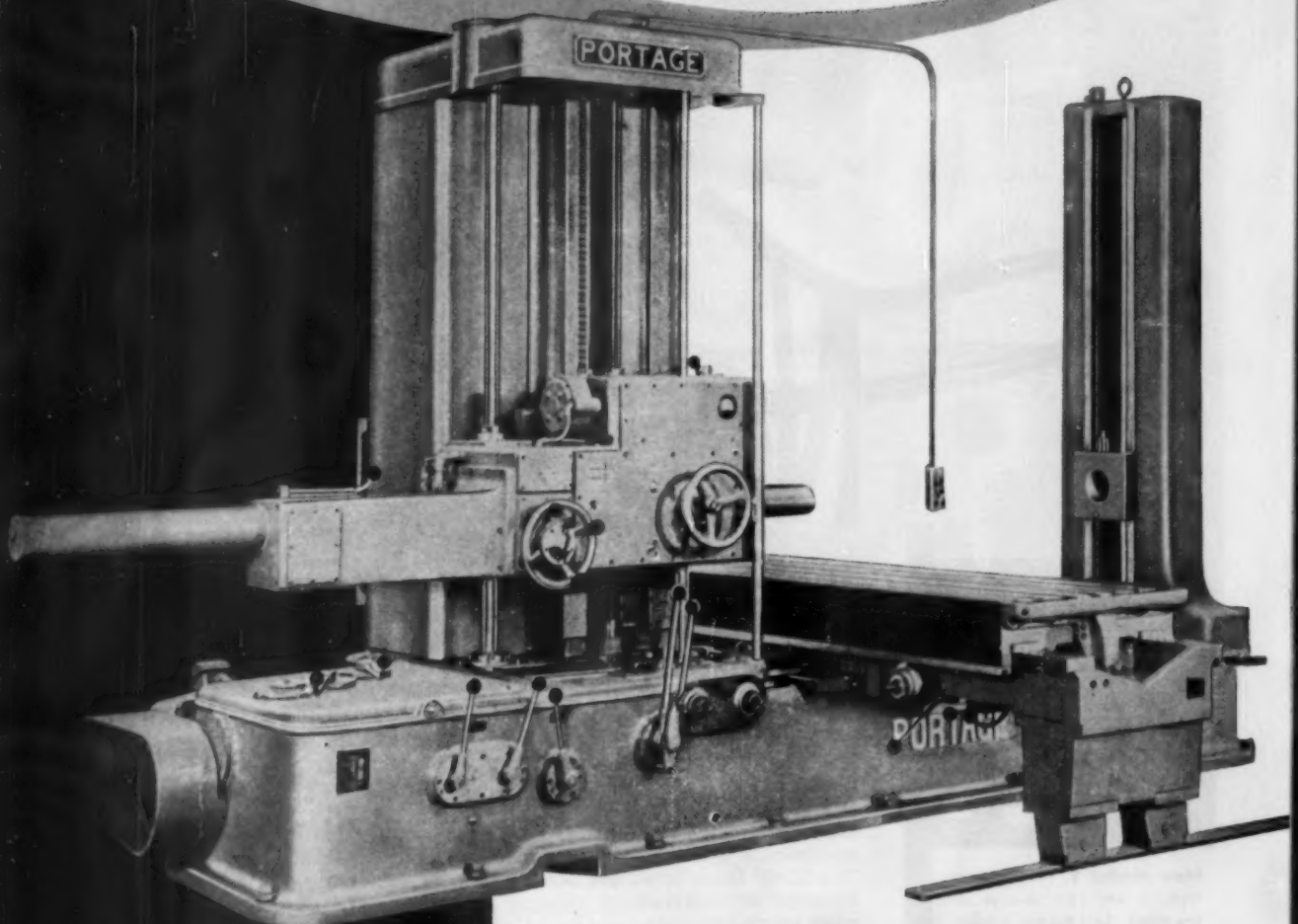
TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

T-P Means TOP Precision

PORTAGE *Announces...the*

NEW LOOK



The new PORTAGE No. 4 Horizontal Boring, Drilling and Milling Machine has a complete NEW LOOK. A heavier base, column, saddle and head are a few of the new features. The overall "beefed up" machine offers a wider range of versatility. NOW... you can handle the larger work . . . with the smallest possible capital investment. Write for complete information.

THE *Portage* MACHINE CO.

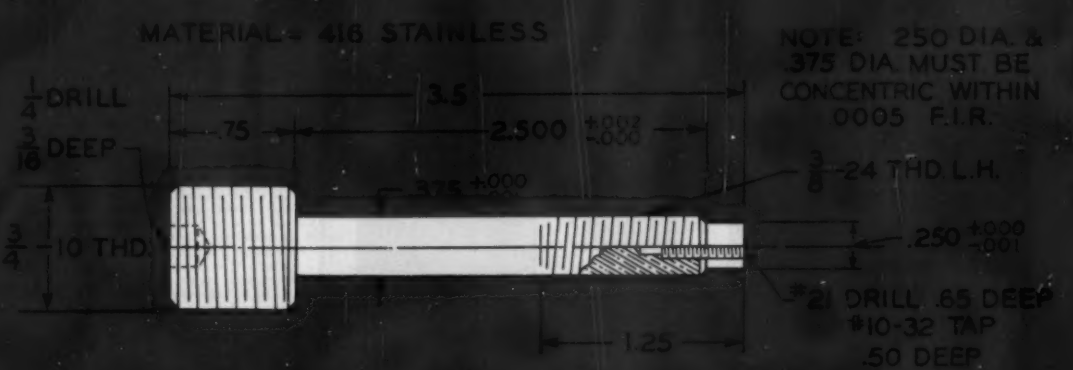
1026 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 19

When Seconds Count...

HOW WOULD YOU MAKE THIS PART . . . FASTER . . . AT LESS COST?



There are two ways to manufacture this valve stud but only one method eliminates secondary operations, saving you time and money . . .

OUTMODED WAY

1. FEED STOCK (TURRET)
2. TURN .375 DIA.
3. TURN .250 DIA. AND SPOT DRILL
4. TAP DRILL
5. TAP
6. FEED STOCK (TURRET)
7. FORM
8. CUT-OFF

SECONDARY OPERATIONS

9. THREAD 3/8-24 LH
10. THREAD 3/4-10 RH
11. DRILL 1/4 DIA. HOLE

SCREWMATIC WAY

1. FEED STOCK (SWING STOP)
2. TURN .375 DIA.
3. TURN .250 DIA. AND SPOT DRILL
4. THREAD 3/8-24 LH
5. THREAD 3/4-10 RH
6. TAP DRILL
7. TAP #10—32 RH
8. CUT-OFF

NOTE: Forming operation will overlap turning operation—Facing .75 dimension with vertical slide tool overlap with cut-off.

Use air clamping pick-up arm to pick-up part and drill 1/4 hole on back burring attachment.

NO SECONDARY OPERATIONS

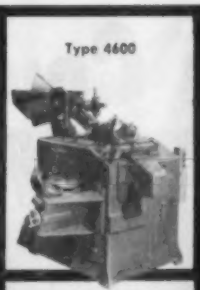
The Detroit Screwmatic 750 is simply constructed yet uses a powerful electronic power flow system. High spindle speeds (up to 7250 rpm) permit fast stock removal; variable speeds prolong tool life and permit use of modern cutting tools. For complete information write for 16-page catalog —see how the Detroit Screwmatic can cut costs for you.

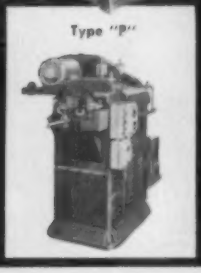
THE GEAR GRINDING MACHINE COMPANY

3919 Christopher • Detroit 11, Michigan

MANUFACTURERS OF: FULLY AUTOMATIC GEAR GRINDING MACHINES • RZEPPA (SHEPPA) CONSTANT VELOCITY UNIVERSAL JOINTS

one operator runs several machines





Automatically Point Bolts and Cap Screws on ECONOMY *hopper fed pointing machines*

For more than 42 years, the Economy line of second operation machines has met with ever increasing acceptance by manufacturers in many fields of endeavor.

Increased production rates with reduced machining costs have transpired with the development of new machines.

The Automatic Pointers are available in two sizes — Type 3300 for uniformly pointing bolts and screws to ⅜" diameter and ¾" to 3½" in length, the Type 4600 for pointing bolts and cap screws, ¼" to ¾" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

Production rates of the Type 3300 vary infinitely from 2000 to 6000 finished parts per hour and on the Type 4600 from 1800 to 5400 per hour.

Also available is the Type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods ¼" to 1½" diameter, 5" or more in length. Production rates up to 2000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing & Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Double End Automatic Pointing Machines

THE ECONOMY ENGINEERING CO.
WILLOUGHBY, OHIO
WILLOUGHBY-OHIO
Designers and Manufacturers of Secondary Operation Machines since 1915

Handle your small part precision JIG BORING on the LINLEY JIG BORER

Why tie up your big, costly jig borers on small work when you can get maximum utility at less cost per hour on a machine exactly fitted to your work? Put your small work on the LINLEY where it belongs and reserve your large machines for large work, *where large work belongs.* You'll save money this way.

SPECIFICATIONS

Table Movement: 6" x 10" — Table Size: 7" x 17½"

Complete details sent promptly on request

LINLEY BROTHERS CO.
664 STATE ST. EXT., BRIDGEPORT 1, CONN.

MECHANICS OF MACHINERY

JUST PUBLISHED, NEW 4th EDITION! Provides a practical background in the functions, geometrical properties, and relative motions in mechanisms in common use. Contains a wealth of data on motions in machinery, kinematics and dynamics; on vibrations, critical speeds, cams and gears, flywheels, governors, etc. **By C. W. Ham, formerly U. of Ill., E. J. Crane, West. Elect. Co., and W. J. Rogers, Northwestern U. 500 pp., illus., $8.50**

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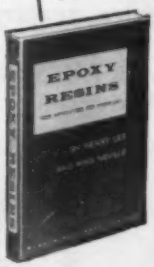

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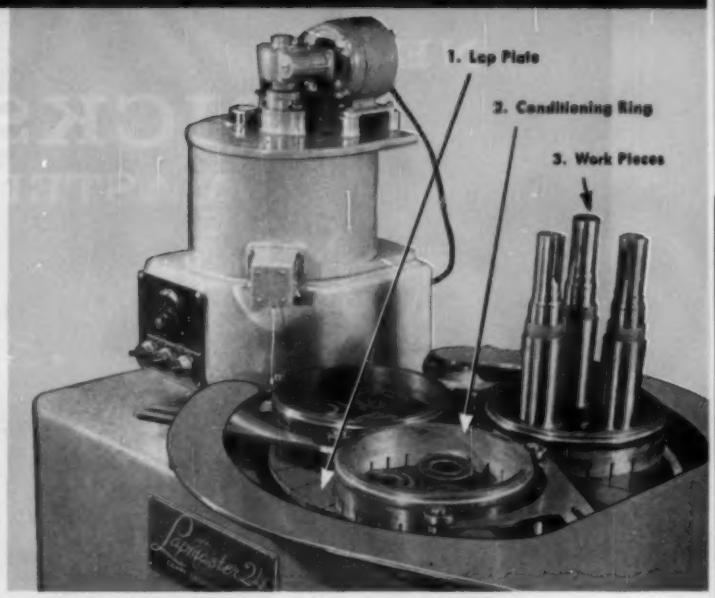
FACTS ABOUT HOW PRODUCTION LAPPING SAVES YOU MONEY—IMPROVES YOUR PRODUCT

With the *Lapmaster*® Principle

The Lapmaster is a versatile precision machine engineered to production *lap* flat surfaces within tolerances of .0000116" or less and microinch finishes of 2 to 3 RMS with absolute uniformity. *Here's how it works:*

1. **Heavy cast iron lap plate revolves slowly under power.**
2. **Large cast iron conditioning rings are held in position and rotate freely on the lap plate . . . continually keeping the plate flat and true.**
3. **Work pieces are placed inside the conditioning rings where they also rotate on the lap.**
4. **Fresh, sharp abrasive grains, suspended in a suitable vehicle, are continuously fed on the lap plate and uniformly distributed under the work pieces during the lapping action.**



WHY THE LAPMASTER IS TRULY A PRODUCTION MACHINE

Identical parts or parts of various shapes, heights and materials can be lapped simultaneously on one machine.

Production is not interrupted or slowed down for replacing or reconditioning lap plates.

Simplicity of design with no obstructions makes loading and unloading easy and simple.

Exclusive design and method of operation with greater effective lapping area permits more loadings per cycle.

Short, predetermined lapping cycles are automatically controlled by a timing clock for greater production efficiency.

Automatic cycling permits pre-loading additional work holders while machine is in operation.

HOW COSTS ARE CUT...PRODUCT IMPROVED

These excerpts from letters sent in by actual Lapmaster users tell the story better than our own words.

"... never been a reject from the work performed on this machine."

"... gives us better quality with less scrap and reduced labor costs."

"... maintenance costs only approximately $85.00 whereas old method was costing approximately $8000.00 per year."

"... machine will save its costs in 2 years by salvaging the mechanical seals for us which would otherwise have been discarded."

"... have dispensed altogether with tests for leakage."

"... the Lapmaster has more than paid for itself—we've eliminated a finish grinding operation and save on expensive fixturing."

HOW DOWNTIME IS ELIMINATED

The Lapmaster is the only lapping machine that does not have to be stopped for redressing or truing the lap plate. Flatness of the lap plate is continuously maintained by the patented reconditioning action of the conditioning rings.

WHAT ABOUT PART SIZE AND SHAPE?

Standard machines in the Lapmaster Line will handle parts from ⅛" up to 30½". Shape or form is not a problem . . . tall or squat, long or short, flat or odd shaped . . . all are being lapped on Lapmasters throughout industry. Monel, steel, tool steel, bronze, cast iron, stainless steel, aluminum, brass, quartz, ceramics, plastics, etc. can all be lapped with the same lap plate.

OPERATOR NEED NOT BE EXPERIENCED

Unskilled operators can be used since the only manual work required is loading and unloading the pieces.

PROVE IT TO YOURSELF WITH THE LAPMASTER TECHNICAL SERVICE

One sure way to find out if the Lapmaster can save you money is to send us samples and surface finish specifications of parts. We'll test run them in our experimental lapping laboratory and furnish you with a complete production report without obligation. Or write for FREE Booklets with complete facts on producing and measuring precision flatness and finish.

Crane Packing Co., 6436 Oakton St., Morton Grove, Ill. (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

John Crane

MECHANICAL PACKINGS

SHAFT SEALS

TEFLON PRODUCTS

LAPPING MACHINES

THREAD COMPOUNDS

CRANE PACKING COMPANY

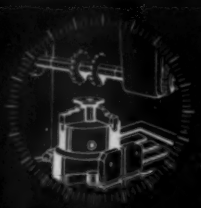
NEW

ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in

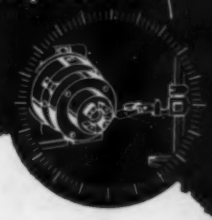


straddle milling

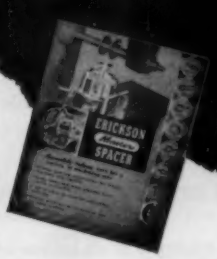
milling

jig drilling
with either micrometer or "Jo" block setting

inspection



Write for free catalog "*Erickson Master Spacer*" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.



The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

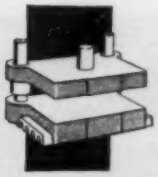
The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-3081

ERICKSON TOOL COMPANY

34350 Solon Road • Solon, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES



NOW all SUPERIOR die sets have Superfinish

GUIDE PINS

HIGH LUSTRE MICROFINISH (2-5 Micro Inches)

Results in

1. **Maximum Surface Hardness**
2. **Increased Bearing Surface**
3. **Longer Pin and Bushing Life**
4. **Greatly Reduces Possibility of Scoring**
5. **SMOOoothher Action**

The process of Super Finishing removes the soft outer skin (appx. .0002-.0003) caused by the heat induced as a result of grinding.

Super Finish eliminates charging which is common to pins lapped with an abrasive compound.

Super Finishing, long a prerequisite in the Automotive and Aircraft Industry for precision bearing surfaces, is now a standard on Superior guide pins. With Super Finished guide pins ideal clearances can be maintained due to a greater bearing surface.

For Fast Local Service Call These Superior Representatives

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another die set advancement by

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

O. S. Walker offers a complete new line of permanent magnetic chucks!

Now, from O. S. Walker, the originator of magnetic chucks, comes a completely new, full line of chucks, with the most permanent magnets ever produced! They're ceramic*, with many times the coercive force of alloy magnets. The face is *all steel*, with no soft insulating material. These chucks offer many important advantages:—

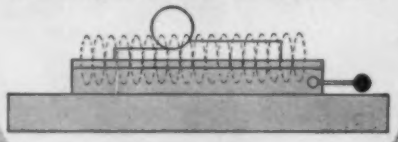
- Weight is 50% less than conventional permanent chucks; minimizes reciprocating table inertia.
- Their low, low height gives greater-than-ever machine capacity.
- Fine pole divisions give maximum holding power.
- All magnetic fields are controlled to prevent magnetization of machine table or ways.

Write for details.

*Patent applied for.

... perfect for milling, too!

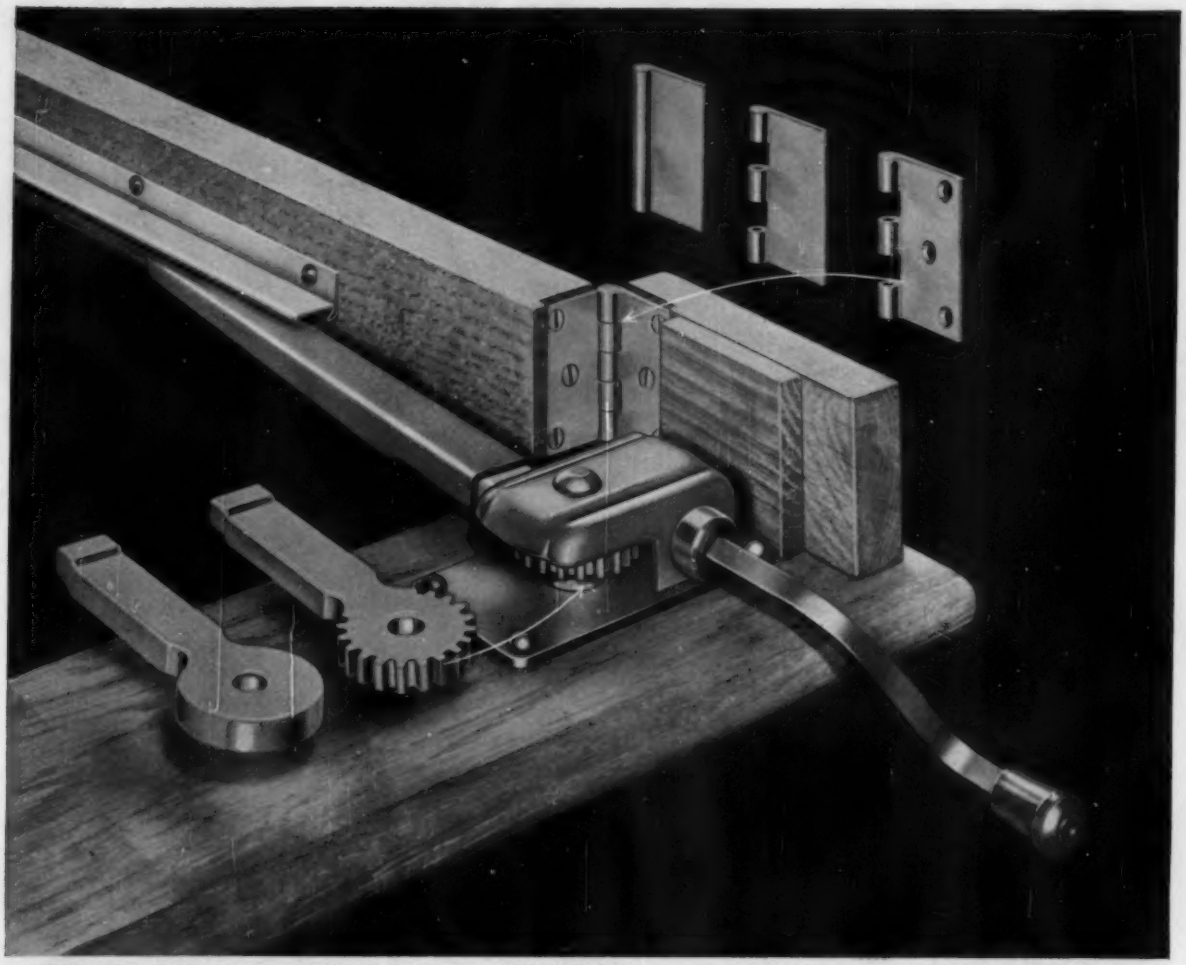
These new chucks are perfect for milling or planing due to their exclusive construction.† Cutter is constantly *demagnetized* as it progresses, with *no* fouling of cutter and work with chips!



†O. S. Walker magnets are polarized *horizontally!*

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASSACHUSETTS

Permanent magnetic and electro-magnetic rotary and rectangular chucks, demagnetizers, lifting magnets, vacuum chucks.



DEMONSTRATION UNIT for the Casement Window Operator, a product of The H. S. Getty & Company, Inc., subsidiary of Trans Continental Industries, Inc. At left on sill is Anaconda Die Pressed Forging for the operating arm gear. To its right is the finished part after trimming operations around circumference of gear head and in the hole—and hobbing teeth in. Upper right: hinge blank cut from long mill length of an Anaconda Extruded Shape – blank with slots milled and pinholes drilled in knuckles – finished hinge leaf.

How Anaconda die pressed forgings and extrusions cut costs for Getty*

Forgings save 30%. The H. S. Getty & Company, Inc., Philadelphia, is a leading manufacturer of marine, window and builders' hardware. They used to fabricate the operating arm gear for their casement window operator (above) from a leaded sheet brass stamping. The American Brass Company suggested a switch to die pressed forgings. Getty tried it, doing a trimming operation in the hole and periphery of the head – then hobbing in the teeth. Metal saving on each unit was 7 ounces. Machining was cut 10% – for an over-all saving of 30%.

Extruded shapes cut machining and finishing. The illustrations above right show the steps in fabricating Getty butt hinges from an Anaconda extruded shape. This short cut to a superior product gave Getty a simplified shop production routine that eliminated several costly machining and finishing operations – because the extruded shape has the exact cross section of the finished hinge. And, because of the dimensional accuracy of extruded shapes, each part is readily adaptable to drill jigs and milling fixtures. These precision hinges will perform well, too, because extruded metal is *wrought* metal – tough, strong, and dense-grained.

Find out how Anaconda short cuts can help you. If the production possibilities of die pressed forgings or extruded shapes look promising to you, send us a sketch, sample, or description of each part you have in mind. We'll be glad to tell you about costs – and about possible savings, too. Address: The American Brass Company, Waterbury 20, Connecticut. 5773

*Subsidiary of Trans Continental Industries, Inc.

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EXTRUDED SHAPES

MADE BY THE AMERICAN BRASS COMPANY

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AC or DC can
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That's why it pays
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LINCOLN IDEALARC

This job required DC welding . . . The next job needed AC.

WITH Lincoln Idealarcs you can schedule any welding job on any machine. You can take any machine to any job. You can do these things because every Idealarc can give you both AC and DC welding current . . . whichever is best for the particular job.

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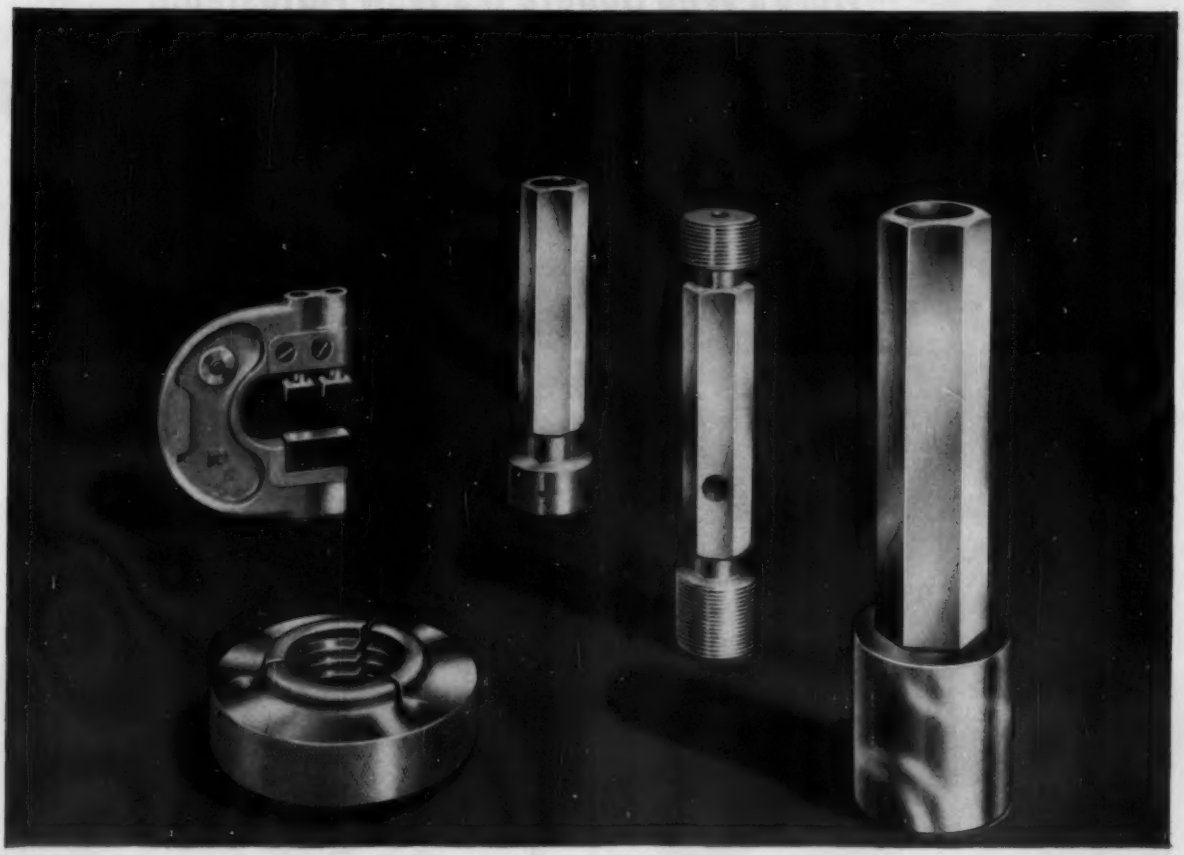

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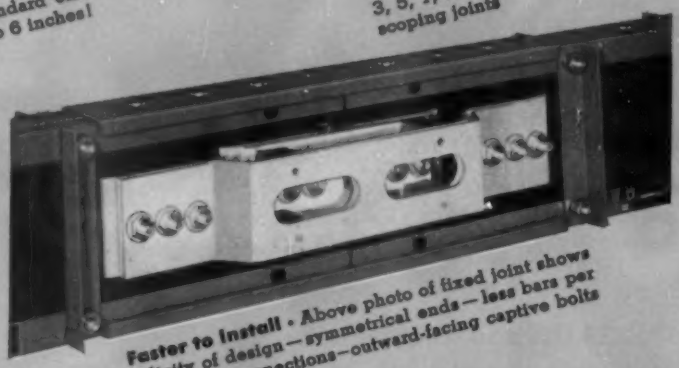
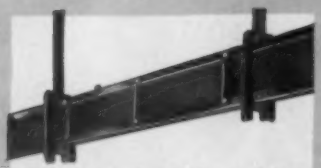
Telescoping joints with multiple slots permit infinite adjustability up to 12 inches when other than standard lengths are required. Standard elbows, T's and X's telescope up to 6 inches!

Fast delivery because any length requirement can be met with standard 3, 5, 7, or 10 foot lengths, plus telescoping joints



Faster to install . Above photo of fixed joint shows simplicity of design—symmetrical ends—less bars per phase—fewer connections—outward-facing captive bolts

Completely adjustable after it's hung. For example, if two ends terminate 6½ inches apart, connection can still be made with a telescoping joint



Totally enclosed for safety —at no price premium. No de-rating necessary. Square D's design eliminates need for ventilation

MORE DESIGN FEATURES

- Thinnest cross-section available! Tight spots, pipes and structural members present less problems
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Write for the complete story
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The advent of the tubeless tire, coupled with ever increasing labor costs, pushed wheel manufacturers to request machines that could turn out better rims at faster rates.

Because McKay Machine engineers know this business better than any other group in the nation, they accepted the challenge.

BETTER RIMS ... automatically

The result is this new McKay Rim Line that is unusually fast, extremely accurate, and completely automatic—enabling a single operator to form finer, more precise rims at speeds never before accomplished.

McKay's new three-stand completely automatic rim rolling line.

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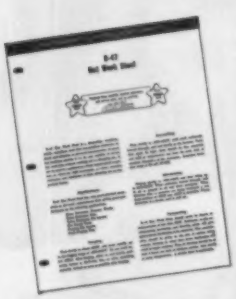
THE McKAY MACHINE COMPANY • YOUNGSTOWN, OHIO

Close-up view of "one-use" rock drill bit and the B-47 die ring which press forges it.

INCREASED ROCK DRILL BIT PRODUCTION 330%



Write for BLUE SHEET on B-47

This concise four-page folder gives all needed handling and shop treatment details on B-47. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. Ask for your copy.

ADDRESS DEPT. AM-94

A midwestern company increased their production of rock drill bits from 1500-3000 per die ring to a consistent total of more than 10,000 bits by switching to Allegheny Ludlum's B-47 die steel.

But of even greater importance, they claim, is the dependability of B-47:

"The less breakdowns we have, the less die changes we must make and the better production we get. Also, we are able to plan our production on the basis of being sure of the reliability of our dies."

Continued high production is necessary to make these special "one-use" bits competitive in today's market. B-47 practically eliminates unscheduled downtime caused by die failure.

A-L's B-47 is a tough hot work steel. It has excellent resistance to shock and abrasion at elevated temperatures. Also, it is especially good for those applications which require ruggedness at relatively high hardnesses.

Check your A-L representative today about Allegheny Ludlum's complete line of tool and die steels—a grade for every job. ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh, Pa.***

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

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Now... Century announces a completely new line of fractional-HP right angle shaft type GEARMOTORS

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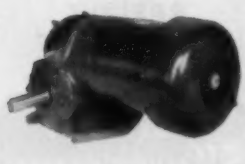
Finest rotary face-type oil seal on high speed shaft
Wide variety of mounting and motor types

Single reduction AGMA output speeds from 25 to 280 RPM (Double reduction as low as 4 RPM)



For floor mounting, complete with new type 56-Frame totally-enclosed, fan-cooled motor. External fan fully protected by cover. Substantial mounting on gear housing supports overhung loads on shaft. Type SC three phase motor shown. Ratings up to ¾ HP.

New IR 40 with 48-Frame motor. Gear housing shown is in one of eight possible positions. Open type single phase capacitor-start Type CS motor. Strong welded foot assembly and heavy motor frame assure smooth operation with severe sprocket loading. Ratings up to ½ HP.

Typical special purpose mounting to suit driven machine. Output shaft is vertical downward extension, properly sealed against oil leakage. Capacitor-start type motor has special smooth cover over capacitor and terminal connections to facilitate cleaning to meet sanitary requirements. Ratings up to ¾ HP.

Basic horizontal unit as assembled with 56-Frame open type motor. Motor is Type SC polyphase. Multi-speed, crane and hoist duty and other special types available. Note convenient vent and filling plugs on gear housing. Ratings up to ¾ HP.

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Precision High Speed Lathe Type D 10
with headscrew and Feed Rod

reliable
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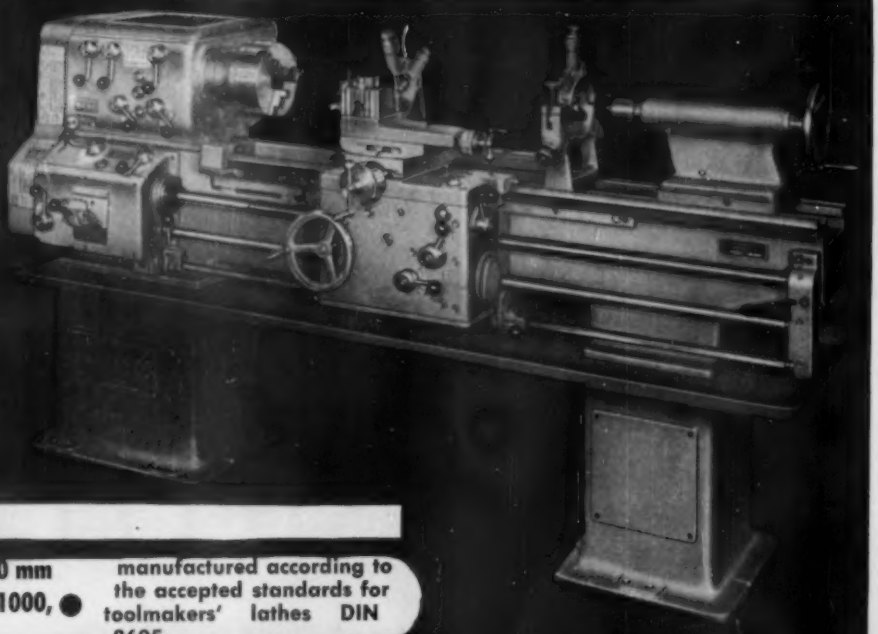

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manufactured according to the accepted standards for toolmakers' lathes DIN 8605

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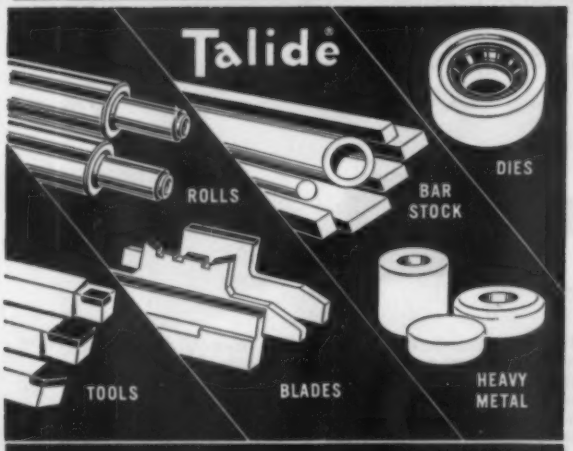

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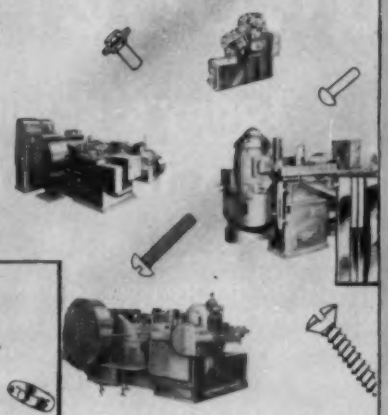

Machinery for mass production of standard and special bolts, nuts, rivets, screws and other cold formed parts.

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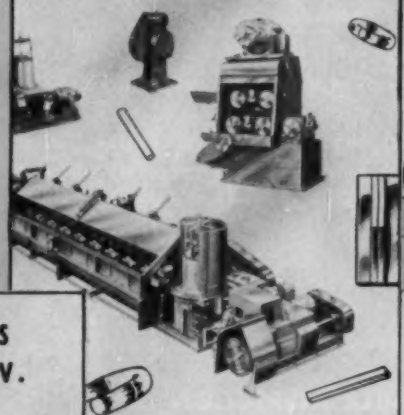

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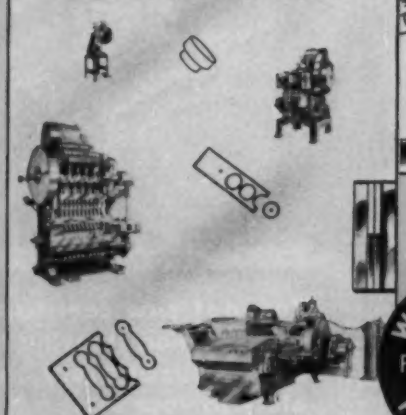

Machinery for quantity production of parts requiring blanking, stamping, forming, deep drawing, threading, trimming, beading or other operations.

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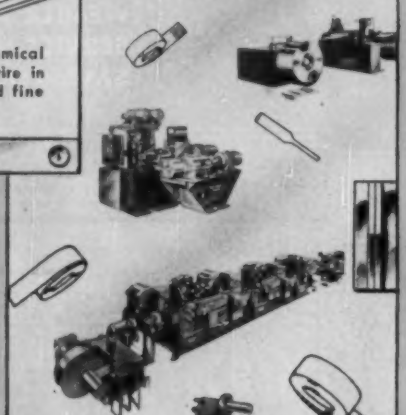

Machinery for rolling strip, wire, rod; drawing tubes, slitting sheet stock for production, warehouse or laboratory use.

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Today's demand for production accuracy requires frequent checking of your gage blocks

Webber Gage Company, largest exclusive manufacturer of precision gage blocks, makes its own laboratory inspection facilities available to all users of gage blocks, regardless of make or model. The service is inexpensive. Your gage blocks are returned to you in less than one week, with a certificate of inspection showing the present size of each block in comparison with master blocks certified by the U. S. Bureau of Standards.

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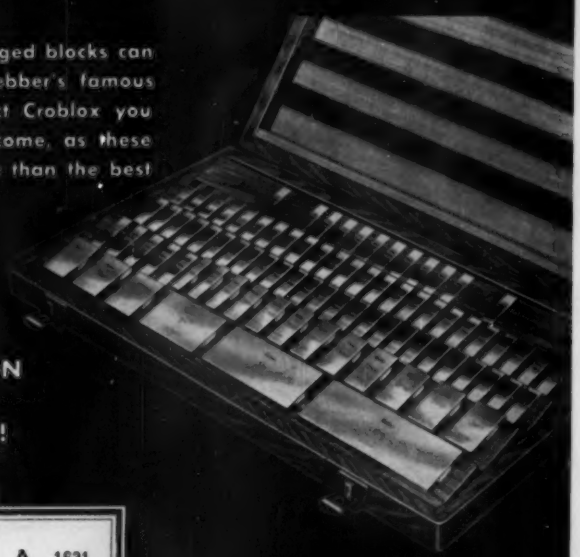

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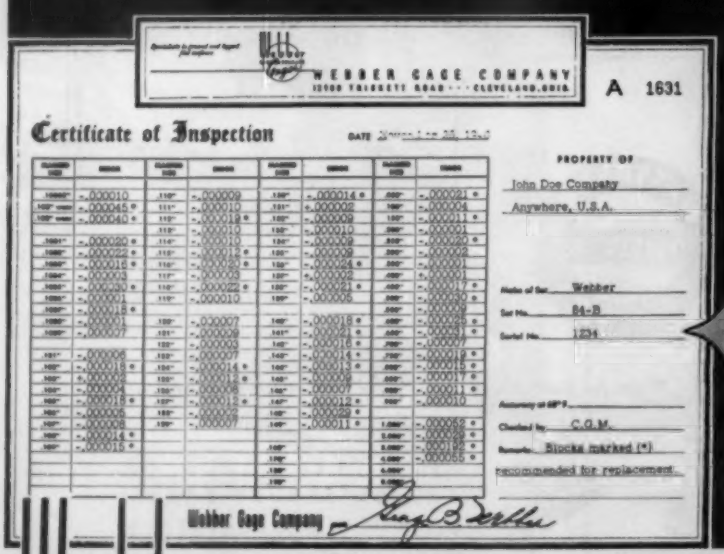

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New drip-proof frame and bearing arms are rigid, durable, corrosion-resistant. No pressed steel or sheet aluminum in any structural part. Famous F-M Copperspun rotor with shaft, fans and centrifugal switching mechanism dynamically balanced as a unit for smooth, vibrationless operation.

Starting capacitors are designed for maximum starting torque . . . minimum starting current. Rugged, trouble-free centrifugal switch features oversized snap-action contacts.

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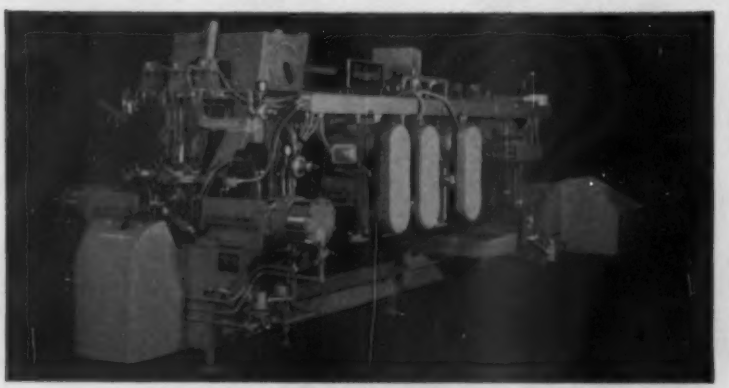
one-source production lines spark interest of volume producers . . .

The prospect of ordering an entire production line, ready made to produce a part to specification, has arrested the interest of many of the nation's top production engineers.

One source responsibility assuring better service; a line 100% harmonic, all stations engineered to work in perfect synchronization; integrated and automated handling of work in process; utilization of common drives and bases, reducing operating costs and floor area, are some of the advantages of the packaged line that has production people talking.

Federal/Warco pioneered the packaged line and have already produced automated lines combining such operations as blanking, forming, drawing, welding, machining, drilling, assembling on a common base.

For additional information contact the Federal/Warco representative nearest you or write direct.



This Federal Packaged Production line welds, spot faces, reams, de-burrs, sets six bolts and welds them in place . . . ejecting finished pedal brackets at a rate of 775 pieces per hour.

Federal / Warco
PACKAGED PRODUCTION LINES

THE FEDERAL MACHINE AND WELDER COMPANY - WARREN, OHIO

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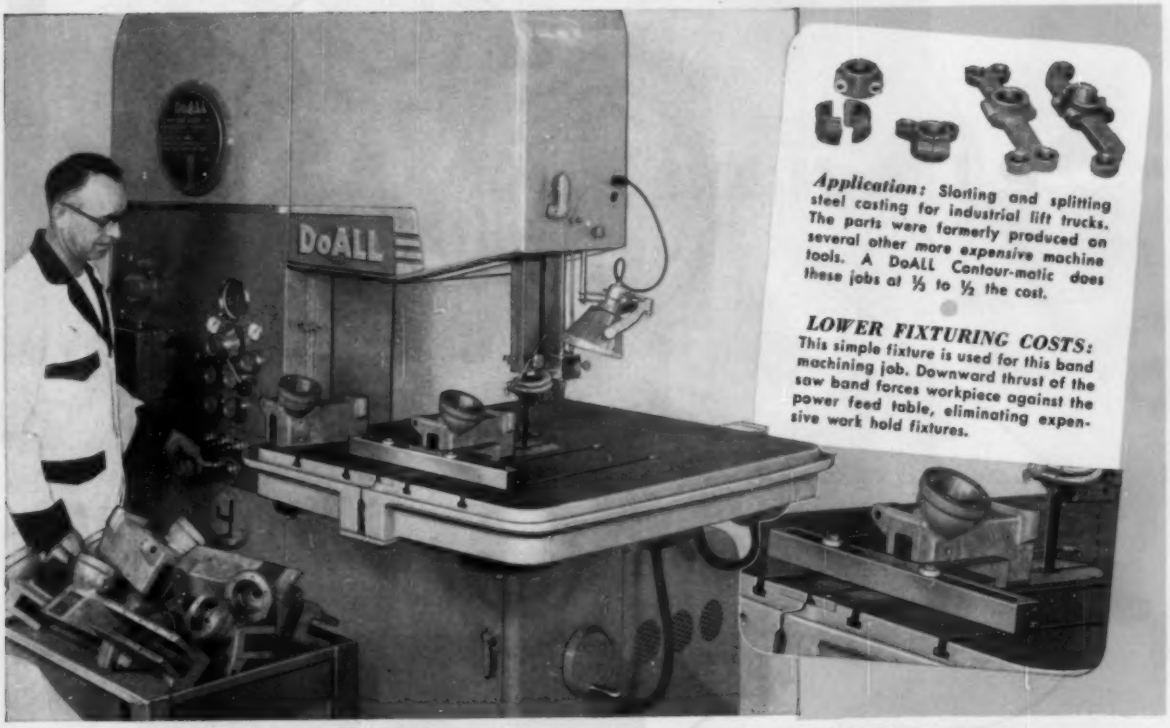
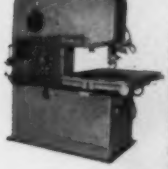
AFFILIATED WITH BERKELEY-DAVIS, INC., DANVILLE, ILLINOIS, MANUFACTURERS OF AUTOMATIC ARC WELDING EQUIPMENT.

Cut Your Slotting and Splitting Costs with DoALL Band Machining


DoALL
Application: Slotting and splitting steel casting for industrial lift trucks. The parts were formerly produced on several other more expensive machine tools. A DoALL Contour-matic does these jobs at ⅓ to ½ the cost.
LOWER FIXTURING COSTS: This simple fixture is used for this band machining job. Downward thrust of the saw band forces workpiece against the power feed table, eliminating expensive work hold fixtures.

DoALL
high-speed steel
DEMON SAW BLADES

Due to its "red heat hardness" characteristics, this HSS saw (with over 1500 cutting teeth) "slices" through the toughest steel—even titanium—outlasting and outperforming any other saw band. Blades withstand cutting temperatures up to 1100° without losing tooth hardness . . . and last up to 30 times longer than carbon steel blades!



New DoALL
Contour-matic

Standard machine has hydraulic power feed table infinitely variable blade speed, built-in coolant system, high horsepower, plus great rigidity for smoothness and accuracy.

DoALL Contour-matic—Industry's Newest High Production Machine Tool!

The band machining application above is typical of DoALL *speed*, *accuracy* and *low cost*. There are HUNDREDS of other duplicate parts production jobs that can also be handled on the new DoALL Contour-matic—with the same results!

The DoALL Contour-matic has proven itself as the only really NEW machining concept developed in years for cutting slots or splitting parts on a production line basis. What makes it possible? A new continuous-cutting *high-speed steel* saw band that accurately "slices" through any machinable metal in a fraction of the previous time . . . plus a powerful band machine with a hydraulic power feed table that automatically guides the workpiece into the blade. This new "integrated" combination of blade and band machine gives you faster, more economical slotting or splitting of all kinds of precision parts. And compare the lower machine investment with other machine tools. You'll realize why industry is switching to band machining for high-speed duplicate parts production!

Other production applications: Contour sawing, notching, slitting, friction sawing, line grinding or filing. Call DoALL locally today for a FREE "in-your-plant" DEMONSTRATION. Or, write for catalogs describing this new basic machine tool.

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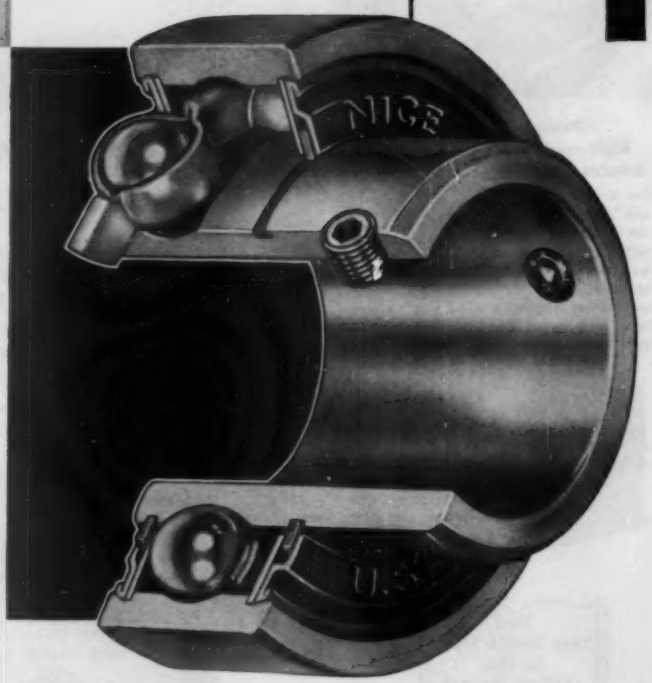
THIS IS A TYPICAL DoALL STORE

PLANNED PRECISION



In a bearing, **PLANNED PRECISION** is the carefully evaluated incorporation of whatever precision features are necessary to provide for the functional requirements of the job—not more, not less. Precision refinements are costly, and should be selected with care to insure products that are both economically and functionally correct.

In the NICE LINE, Product Designers will find a complete range of ball bearings incorporating varying degrees of precision. NICE catalog standard bearings are available in precision, semi-precision and unground types. If a specially designed bearing is the correct answer to the application problem, NICE engineers are qualified and capable "Specialists in Specials".

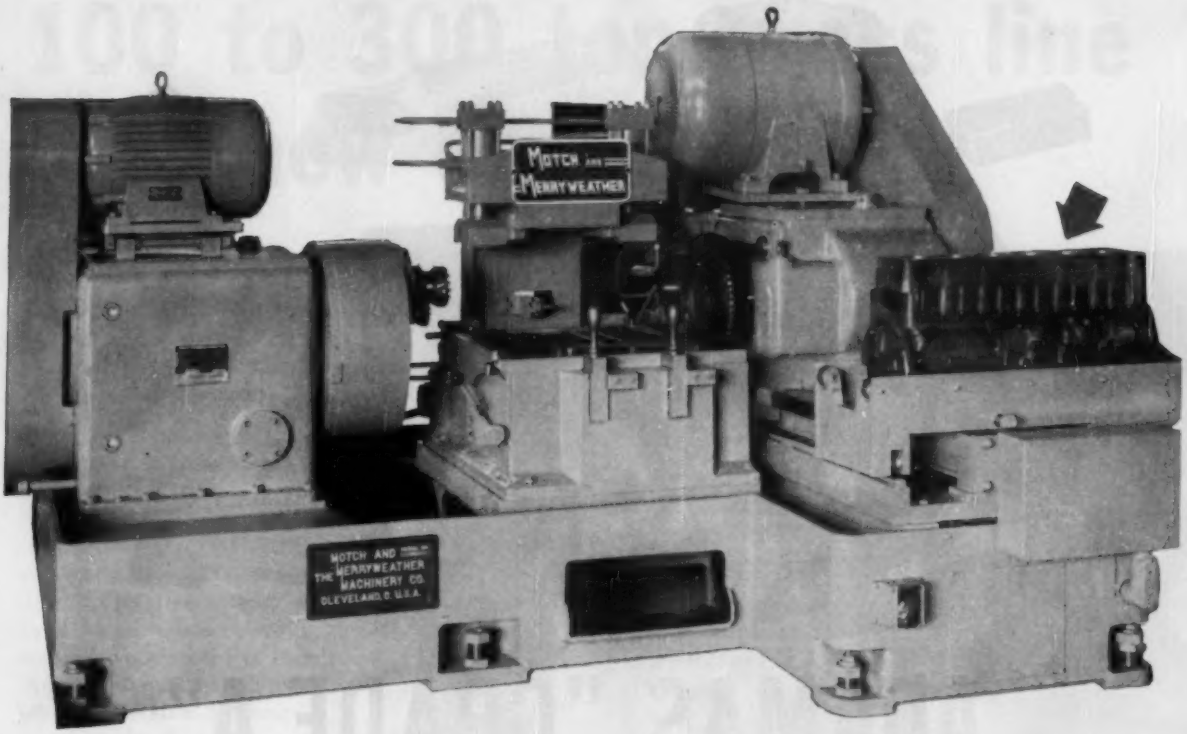
Write for Catalog No. 190

NICE

NICE is the word for **BEARINGS**

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

M&M develops another specialized machine



Special Duplex Milling Machine

more than doubles milling production on cylinder blocks

A prominent automotive manufacturer—comparing this M&M machine with previous equipment used to mill ends of cylinder blocks—reports:

In addition to boosting production from 22 to 50 blocks per hour, this M&M machine has greater strength in planetary milling unit, gives longer cutter life and more accuracy. Its extreme rigidity permits rough and finish operations in one pass of the heads.

An operator positions the block in the fixture where it is automatically clamped. The right hand head feeds across one end of the block while the left hand planetary head profiles the flywheel housing mounting surface. Cutters rapid traverse back, fixture is unclamped and finished block is removed.

Machine Tool Manufacturing Division

MOTCH AND MERRYWEATHER

Cleveland, Ohio

ADAMAS "GRADE A"

PERFORMANCE WINNER

For its role as the "standard of the industry" Adamas Grade A ranks as performance winner among all competing 6% cobalt straight tungsten carbide grades, (industry classification C-2).

Grade A's outstanding performance in cutting tools, dies, and wear parts has won the applause of carbide users throughout the United States and Canada. Here is a dramatic sample of Adamas Grade A throwaway inserts in action on a typical turning operation of Navy "type D" cast iron . . .

192 pieces per corner with a .250 depth of cut, 170 S.F.P.M. and .018 feed.

Even in the carbide industry, stars are made not born. Grade A's success is the result of Adamas' unique manufacturing processes which give Grade A its superior combination of three key metallurgical properties: . . . hardness . . . density . . . and transverse rupture strength.

Benefit from Grade A's metallurgical superiority . . . write today for your free copy of: "Grade A . . . Metallurgical Facts and Application Tips".

Address Dept. 254

Contact Adamas for the name of your local distributor.

ADAMAS CARBIDE CORPORATION, KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL and CERALOX.

NEWS FROM HAMILTON!

100 to 300 ton press line sets new standards

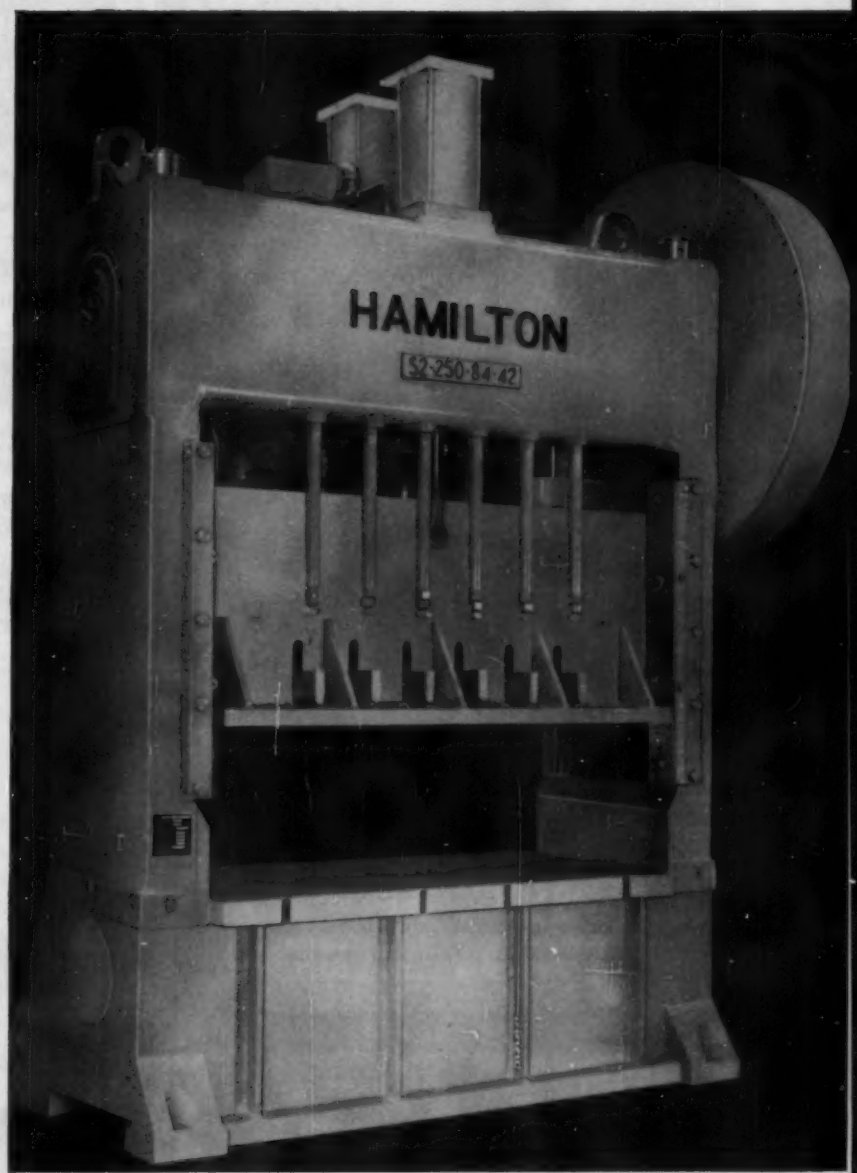
Hamilton offers you 100 to 300 ton presses built to meet exacting automotive production standards . . . standards pioneered in the automotive field through more than 30 years of Hamilton's leadership in building presses.

Every one of these 2 point, single acting, straight-side, double-crank presses is a brand new design. Each is engineered for constant top-speed, top-quality production — without profit-robbing downtime. Each is built for complete operating flexibility. Here are a few of Hamilton's design features that will mean more efficient operation for *you:*

- **mechanically interlocked air clutch and brake**
- **barrel-type motorized slide adjustment**
- **automatic lubrication**
- **pneumatic flywheel brake**
- **die lights**
- **die cushions**
- **pneumatic counterbalances**
- **interlocked electrical clutch control**

Exact specifications are adjustable to your individual requirements. Special electrical controls are available to meet particular electrical standards.

It will mean money in your pocket to find out today how these all-new Hamilton presses can help you turn out high quality stampings fast . . . without costly production downtime. Get the full story on these new 100 to 300 ton presses . . . from Hamilton Division, B-L-H Corporation, Hamilton, Ohio.



Hamilton's brand-new 250 ton double-crank press with 84 x 42 in. bed and slide.

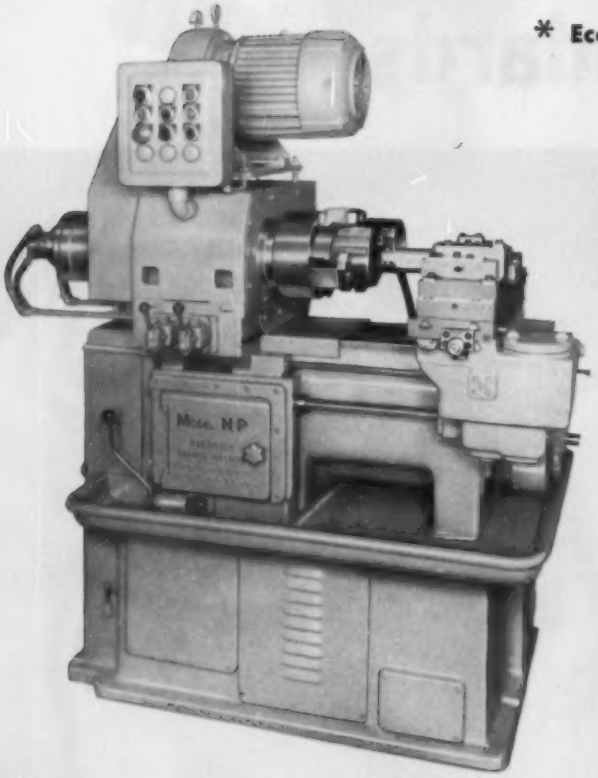
Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools

BALDWIN BLH LIMA-HAMILTON

NEW MACHINE OF THE MONTH
NEW ECONOMY* IN PRECISION BORING

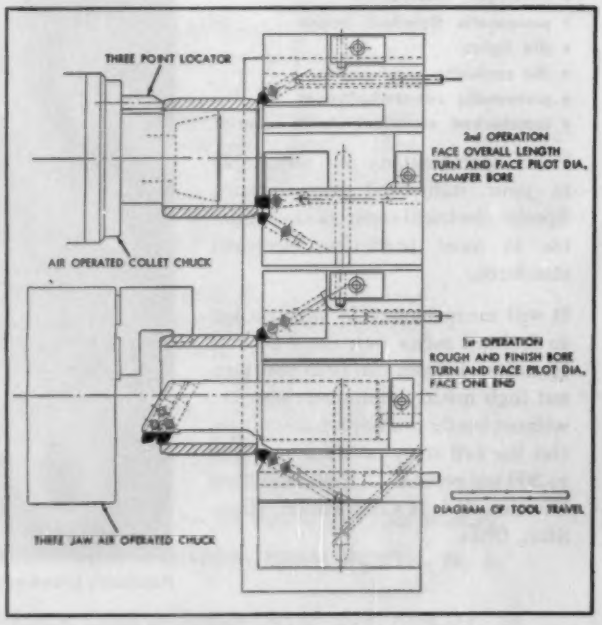


*** Economy in initial investment**
Economy in machining costs
Economy in maintenance costs
Economy in change-over time

The new Seneca Falls Model "NP" Precision Boring Machine is a top quality, reasonably priced, mechanically operated machine available with either one or two precision spindles mounted independently on a fixed bridge. Either the work or the tools can be rotated on the spindles. The patented "Quick Change-over Mechanism" permits variations in carriage stroke, rapid traverse and feed cycle without changing or purchasing additional cams and reduces average changeover time to less than thirty minutes. The design of the headstock bridge permits the installation of other makes of standardized boring heads.

Let our engineering staff help solve your precision machining problems.

The two-spindle machine illustrated above is equipped for boring, facing and rabbeting both ends of field rings in a single machine cycle. When the operator removes a finished piece from the rear chuck, he transfers a semi-finished piece from the front chuck and replaces it with a rough piece. When the starting button is pressed, the tools move forward in rapid traverse to cutting position, automatically shift to cutting feed, and finally return to starting position in rapid traverse. The entire operation is automatic. The field rings are 4-½" in diameter and a production of 60 pieces per hour at 100% efficiency is easily maintained. Tooling arrangement is illustrated opposite.



SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

SENECA FALLS MACHINE CO.
SENECA FALLS, NEW YORK

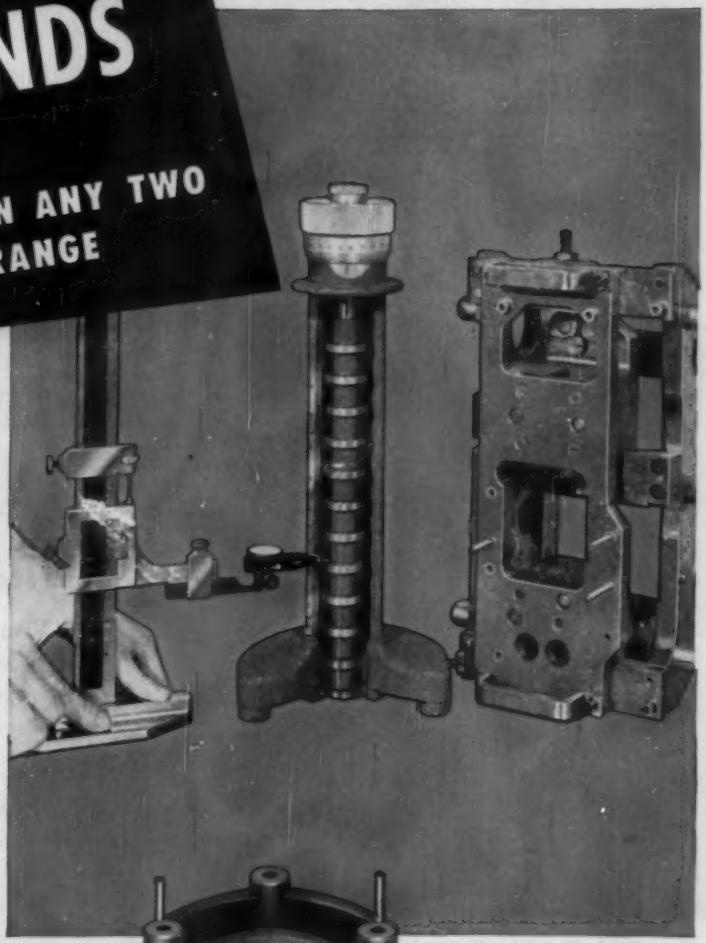
Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



Cadillac PLA-CHEK

SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

Cadillac

GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

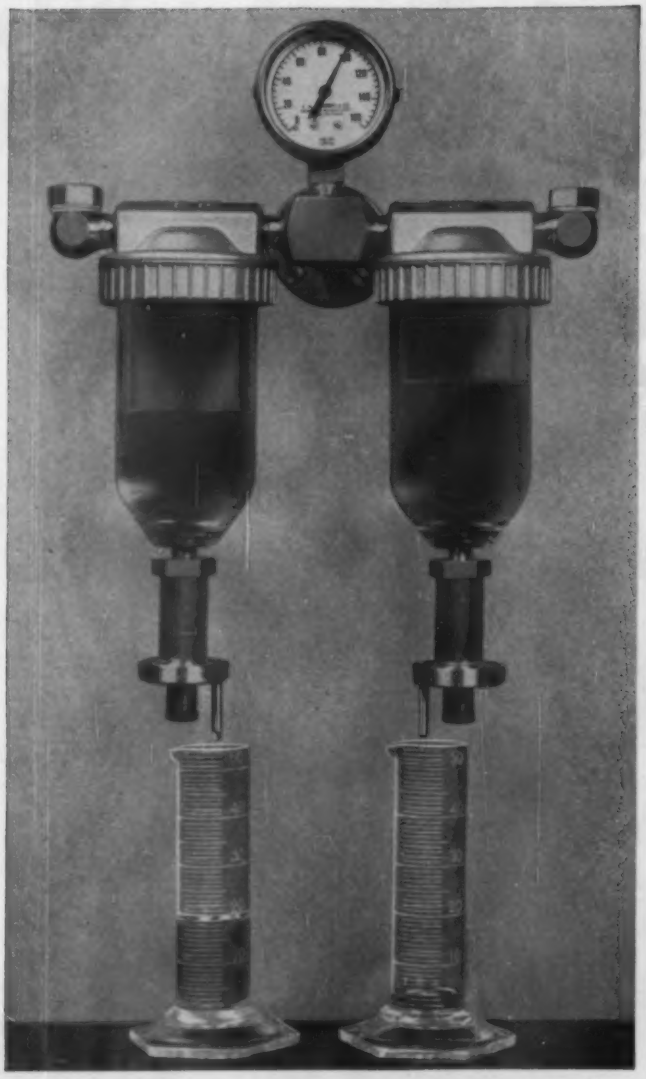
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____



ANTILEAK DEMONSTRATION

Suntac oil in one chamber, your present hydraulic oil of the same viscosity in the other. Both oils are forced out through sintered bronze bearings. In this photograph, pressure of 100 psi caused a straight mineral oil to leak out four times faster than Suntac.

SUNTAC CUTS HYDRAULIC OIL LOSS AS MUCH AS 75%

See this demonstration in your plant

Take about five minutes at your own desk to learn how Suntac® oils stay put in hydraulic systems . . . reduce oil loss through loose joints and worn fittings.

Match Suntac against the hydraulic oil you're now using—see how the exceptional non-gummy antileak characteristics of Suntac can reduce your oil losses as much as 75%. *Some users have even reported savings of 90%.*

Call Your Sun Representative

Have him arrange with a Sun Lubrication Engineer to give you and your staff a private demonstration. For further information on the uses of Suntac in hydraulic systems and in general lubrication, write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-10.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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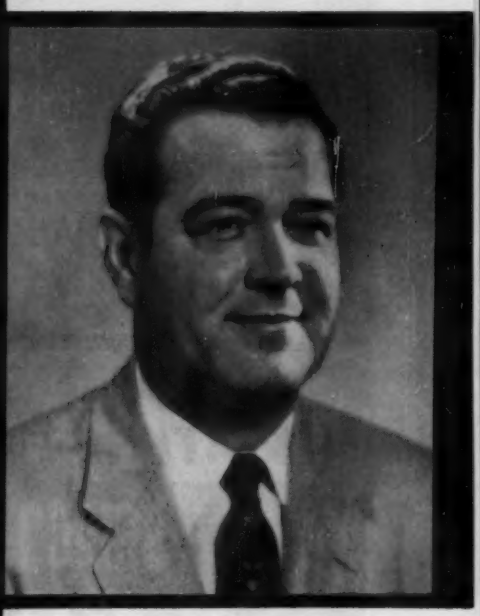
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

people buy Scott Wipers for many reasons:



Mr. Orville Barr, Ekco's Chicago Plant Manager, likes soft, absorbent, 2-ply paper Scott Wipers for all clean-up and maintenance wiping. They're Perf-embossed®, a special process which makes them ideal for wiping (1) planers, (2) rolls, (3) punch presses, (4) forming presses, (5) milling machines.

At EKCO, Scott Wipers cut wiping costs 18%

Ekco Products Company's Chicago plant employs 1,400 people making about 1,300 nationally famous kitchen items. Tired of excessive costs with cloth wipers—pilferage, sorting, counting, storing, laundering and dispensing—Ekco switched to Scott Wipers 3 years ago. Besides helping to protect dies valued at $3,000 to $12,000 each, Scott Wipers have saved Ekco 18% to 20% annually in wiping costs.

SCOTT PAPER

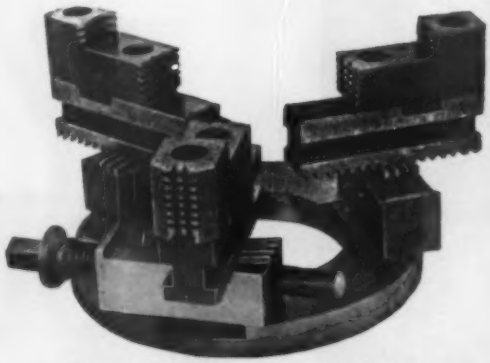
For Ekco case history—complete facts and figures—phone your Scott Distributor . . . listed in the Yellow Pages under "Paper Towels." Or write Scott Paper Co., Dept. AM-710, Chester, Penna.

Maker of the famous Scott paper products you use in your home.
See "Father Knows Best" and "The Gisele MacKenzie Show" on NBC-TV.

FORKARDT CHUCKS

THE *New* Chuck for Every Type of Work

One-inch "Teeth" — with Twenty-Ton "Bite"



Internal working parts of the Forkardt chuck

SPECIAL FEATURES:

- Higher gripping power
- Higher accuracy
- Higher resistance to wear and tear
- Non-divided chuck body—made of steel
- All operating parts made of NITRALLOY STEEL — HARDENED — GROUND
- No bevel wheels
  No toothed wheels spiral threads
- Interchangeable jaws
- Same jaws for External and Internal gripping
- Transmission effected throughout by surface control. Large gear ratio

HAND OPERATED — POWER OPERATED

WRITE FOR LITERATURE

PAUL FORKARDT KOMMANDITGESELLSCHAFT DÜSSELDORF

GERMANY

U.S. DISTRIBUTOR: MIDWEST-OVERSEAS TRADING CORPORATION, 647 W. VIRGINIA STR., MILWAUKEE 4, WISCONSIN

TWO NEW MINIATURE GRIPCO FASTENERS

FOR

- **Hard to reach assemblies**
- **Thin metal applications**
- **Automatic feeding**
- **LOW COST fasteners**

Gripco Miniature Pilot Weld and Clinch Nuts, with or without the famous Gripco locking feature, provide low cost fastenings in blind assemblies or as extra threading depth for thin metals. Miniature size ideal where space is limited. Sizes #4 through ¼" in Miniature Series, fine and coarse threads. Sizes ¼" through ⅝" are available in standard dimensions.

Large inventories carried for immediate shipment. Brass and Aluminum made to special order.

Write for samples and full details.

GRIP NUT COMPANY

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TRUE-TRACE MACHINE TOOL CONTROLS

Send for new 24 page catalogue

Greater production and increased profits thru 1, 2 and 3 slide control hydraulic tracers and numerical controls.

TRUE-TRACE SALES CORP.

EL MONTE 17, CALIFORNIA

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY

23018 North 11th St. • St. Louis 6, Mo.

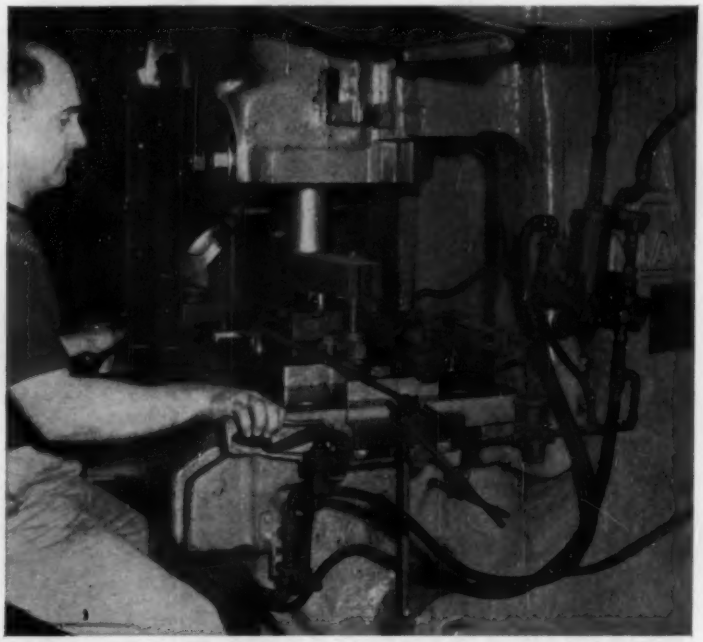
CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 23018 NORTH 11TH ST., ST. LOUIS 6, MO.

For automation and safety... Schrader Packaged Air Sets upgrade machine tools

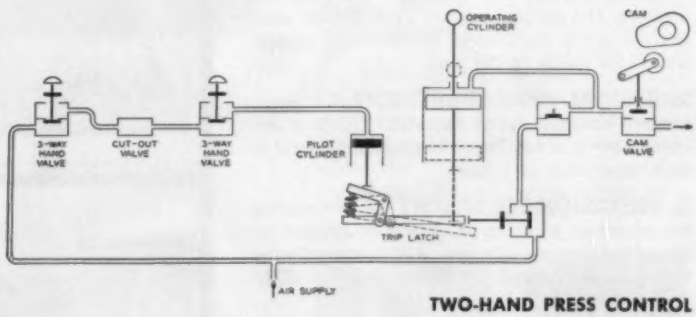


Punch press will not operate unless both hand valves are pressed at once. The press cycle cannot be repeated until the hand valves are released and the pilot cylinder is vented to atmosphere by the cam valve. A cutout valve prevents continuous press operation with one hand valve tied down. Air ejection is accomplished by cam action that actuates air column. Safety first with a Schrader Packaged Air Set.

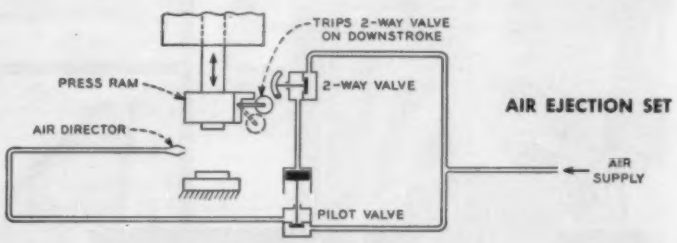
Schrader Packaged Air Sets eliminate hazards to press control and ejection systems operators like the man at right. They force him to keep his fingers free because the hands that feed the press or tool must also operate it. And both hands *must be used at once*—can't stray into danger. Fast, clean air ejection—moves the part off—automatically!

At the same time, performing both stamping and ejecting, finger and toe-tip action is light as air—keeps this operator fresh and efficient—steps up production! You can have the same!

Use these versatile pneumatic machine controls and air ejection sets not only on power presses, but shears, brakes, friction clutches, and any machine using a mechanical clutch. They are "off-the-shelf" items—ready to use! Write Schrader for details. Our distributors are located close by. Your most special requirements will in all likelihood be no problem at all with convenient, low-maintenance Schrader packaged control sets.



TWO-HAND PRESS CONTROL



AIR EJECTION SET

Schrader®
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QUALITY AIR CONTROL PRODUCTS

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Please send latest informative booklets which show Schrader's complete line of products.

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Could you duplicate these OK hardened ways?

Here are only a few of the wide variety of shapes made possible by OK 3-point advantage:

1. LAMINATED CONSTRUCTION Through Ohio Knife's own process, long-wearing tool steel is welded to a soft steel backing under 2500 tons pressure. This process enables us to deliver ways answering any requirement for hardness, regardless of the shape of the way.

2. SPECIAL HEAT-TREATMENT OK ways' extreme hardness (65-66 Rockwell "C") to a uniform depth is a key factor in successful performance regardless of shape.

3. PRECISION EQUIPMENT Ohio Knife has the extensive plant facilities and equipment required for supreme accuracy. OK hardened ways and gibs are ground to tolerances of ± .0002.

Besides a wide range of standard sizes and shapes, OK ways are made to your specifications.

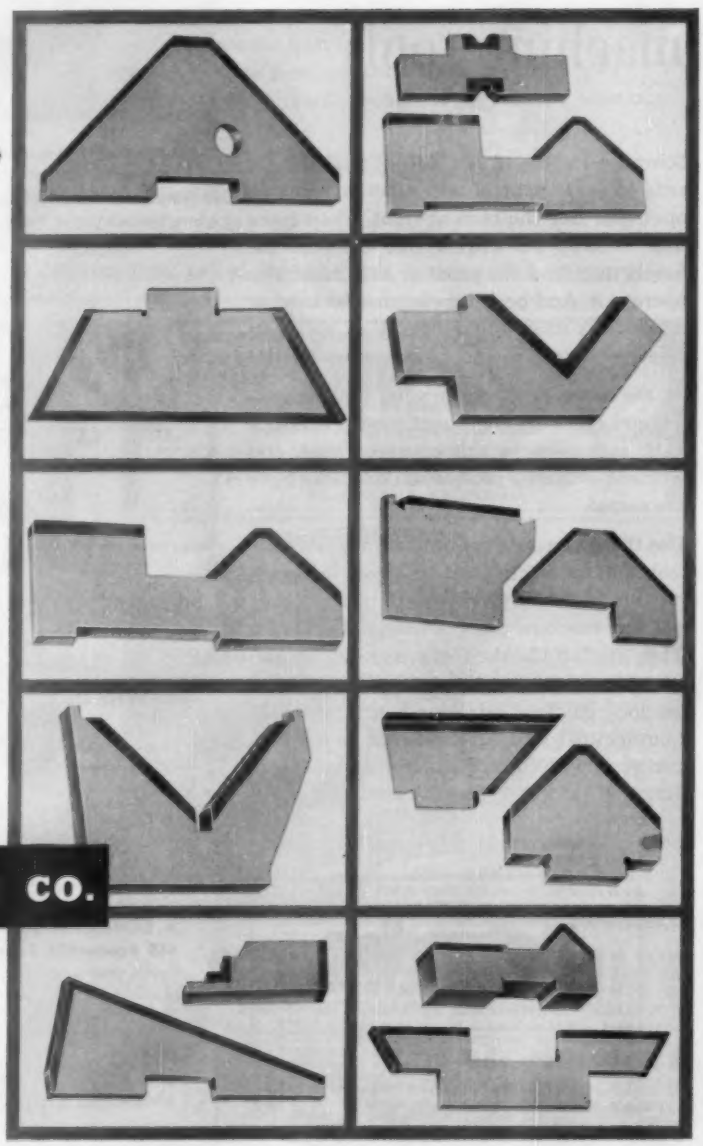
For FREE bulletin showing seven standard cross sections in over 60 sizes, Write Dept. 30-W.

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

Manufacturers for the Metal Working Industry of:

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS
ROTARY SHEAR KNIVES • HARDENED SPACERS
HARDENED WAYS • BALL RACES
WEAR STRIPS • GIBS



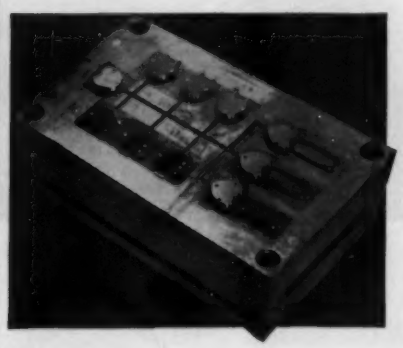
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Lustre-Die Takes High Polish For Molding Plastic Rattles

Shreve Molded Products, Youngstown, Ohio, needed an injection mold for the production of heart-shaped parts for baby rattles, using acetate and styrene plastics. They wanted a mold capable of taking a high polish, so as to produce unusually attractive parts. In addition, the mold had to have the stamina to perform economically during long production runs.

The problem was put up to Læed Steel Co., Buffalo, N. Y., Bethlehem's local tool steel distributor. Their recommendation was Lustre-Die tool steel. It proved to be an excellent choice, too, for the mold, which was produced by Tri-Penn Tool Co., Erie, Pa., has been satisfactory in every way.



Lustre-Die is ideal tool steel for producing plastic parts because its properties enable it to take an unbelievably bright, mirror-like polish. Not only does Lustre-Die have the proper basic analysis for working with plastics—we even go a step beyond that by adding alloy fortification. We also build up the steel's excellent properties by oil-quenching and tempering, so that it can be furnished ready for machining and polishing.

Lustre-Die is made in the electric furnace, and is carefully inspected to insure cleanliness. It has a minimum of inclusion-causing additions. Besides, modern inspection methods hold injurious porosity to the minimum.

If you have any questions about Lustre-Die, or if you would like to give it a trial run, your Bethlehem tool steel distributor will be pleased to assist you.

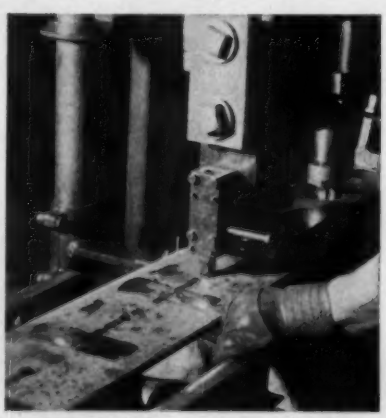
BETHLEHEM TOOL STEEL ENGINEER SAYS:

It Pays to Keep Tools Sharp

In many shops, resharpening of production cutting tools is sadly neglected. In an effort to keep output high, too many tools are kept in use beyond the point where the cutting edges become excessively dull.

What happens when edges are dull? The dull edges cause an increase in the service load of the shearing or cutting operation. If the dullness is carried to extremes, tools break. Dull edges also produce rough surfaces on the parts, which may lead to rejections due to defects, or because the permissible tolerances have been exceeded.

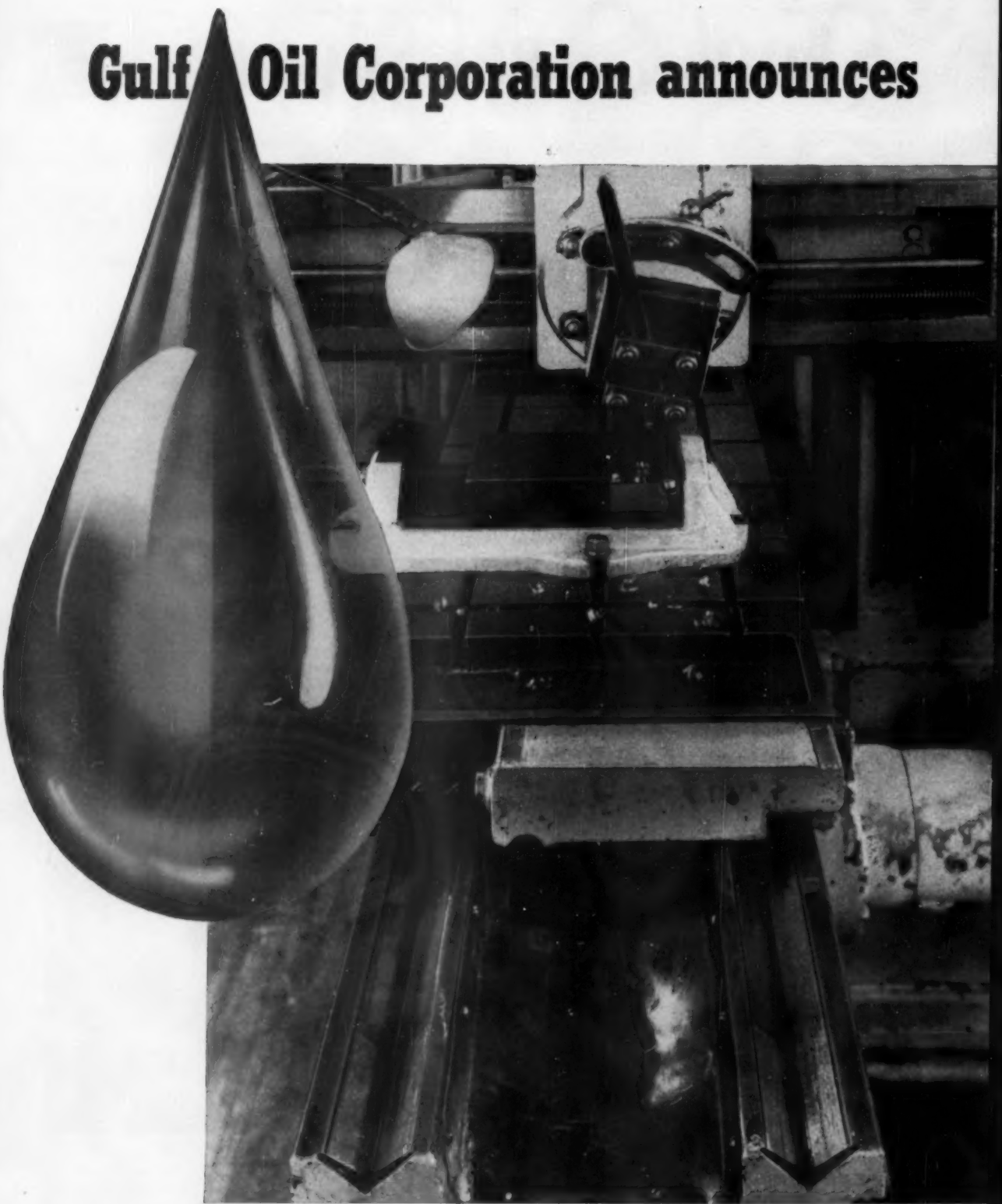
Should resharpening be delayed too long, it may be impossible to recondition a tool properly, as deep spalls, cracks and gouges cannot be removed. Usually there is an economic balance point where it is best to resharpen, and for each operation this should be determined in advance. Tools should also be inspected regularly, to prevent excessive dulling. Intelligent use of preventive maintenance of cutting edges can work wonders in providing longer tool life and fewer broken tools.



Bearcat Puts Square Holes in ½-in. Plate

In this operation, photographed at Frink Sno-Plows, Inc., Clayton, N. Y., Bethlehem Bearcat is putting 11/16-in. square holes in carbon-steel plate, used as cutting edge of snow plows. Though the steel plate is 1/2 in. thick, the average life of each punch is 5500 holes.

Gulf Oil Corporation announces



Gulfway meets machine tool manufacturers' specifications as a way lubricant and hydraulic medium for grinders, milling machines, planers and boring machines, lathes and other machine tools.

GULFWAY

new three-purpose oil for smoother operation of machine tools

AS A WAY LUBRICANT

Gulfway forms an exceptionally slippery and tenacious film on slides and ways. Its inherent high oiliness is bolstered by a tackiness agent that keeps it sticking to metal. Gulfway will not squeeze out when the table is at rest for long periods. It contains a special low-shear additive that maintains lubricity when clearances are tight or loads are excessive. Gulfway eliminates "stick-slip" chattering that shortens tool life and causes excessive wear of the ways.

AS A HYDRAULIC FLUID

Gulfway will not plug hydraulic lines and controls and cause pumps to work erratically. It flows freely at all times, even after long periods of dormancy—needs no run-in or warm up and places no strain on pump or motor.

AS A BEARING AND GEAR OIL

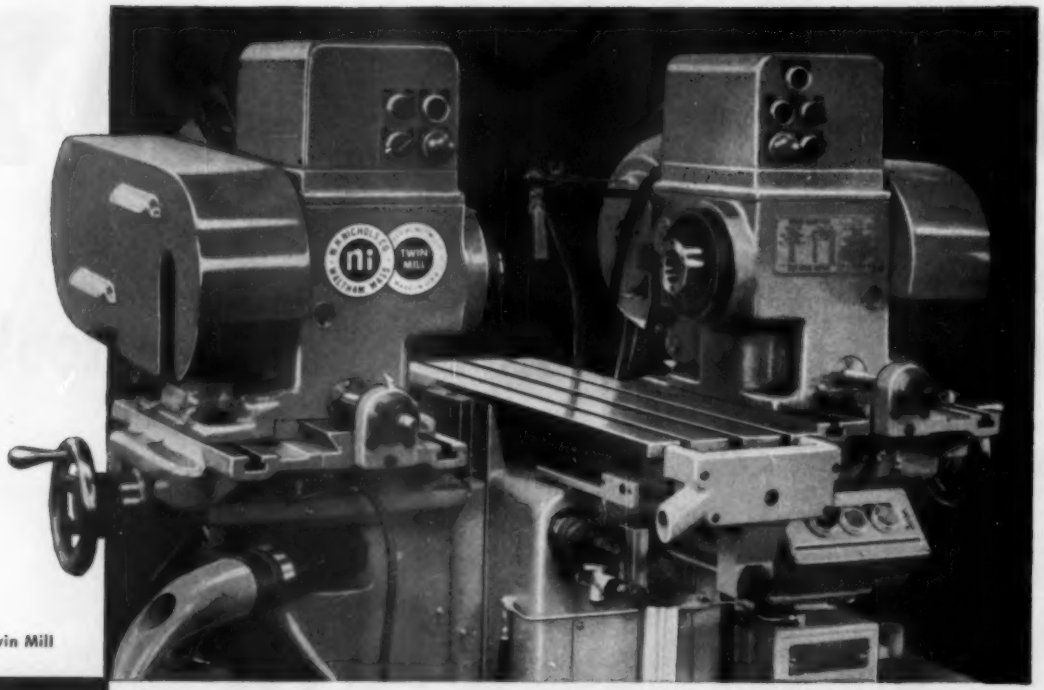
Gulfway's characteristic oiliness and high load-bearing capacity make it an ideal lubricant for machine tool gears and bearings. Its long service stability provides an extra margin of economy.

Gulfway is available in two different viscosities. Why not make this new oil prove itself in one or more of *your* machines? Contact your nearest Gulf office, or write to:

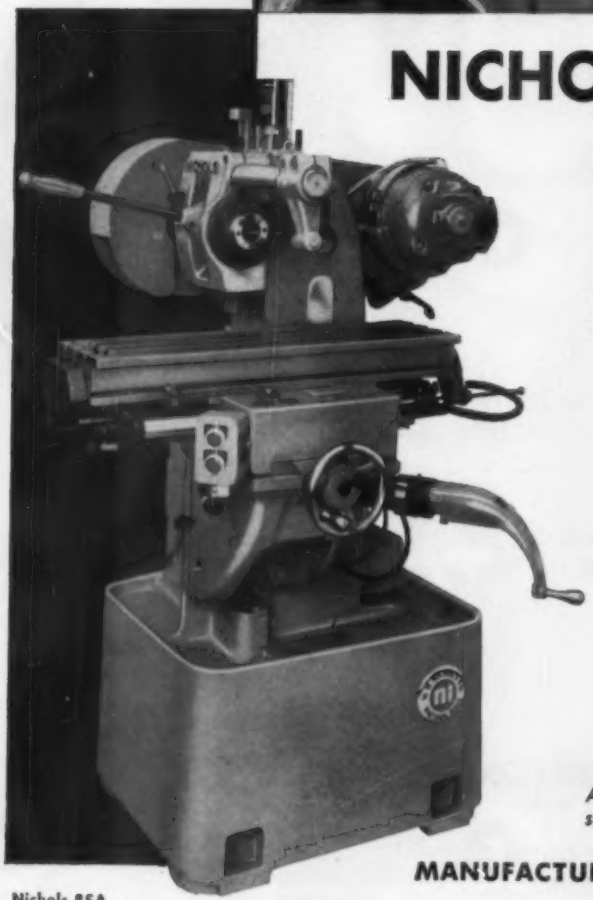
GULF

GULF OIL CORPORATION
1822 Gulf Building
Pittsburgh 30, Pennsylvania

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



Twin Mill



Nichols 85A
Semi-automatic

NICHOLS MILLERS . . .

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **THE ROBERT E. MORRIS COMPANY**

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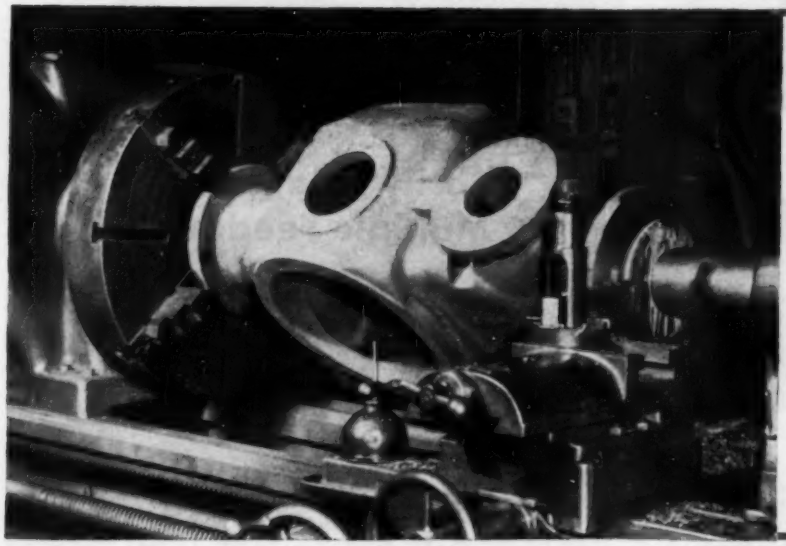
42.5% S·M·I*

for FERROCARBO®-TREATED IRON



Finer grained, denser, and stronger castings result from FERROCARBO-treated iron. This has been proved by comparative tests conducted in several independent laboratories on untreated iron and FERROCARBO-treated iron of the same chemistry. Rapid, controlled disintegration of this patented cupola additive by CARBORUNDUM produces a more fluid iron and therefore a more machinable casting due to fewer segregations and chilled or hard spots. Make sure that FERROCARBO has a place in your production picture.

* Surface Machinability Improvement

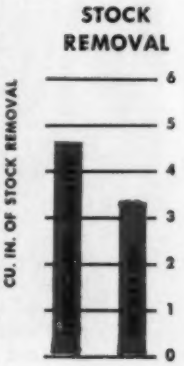
Tool wear tests were conducted with a single point "Carboloy" grade 44A tool on castings machined at commercial speeds. Flank wear was measured with a 20 power microscope.

HOW TESTS WERE CONDUCTED

These outstanding test results were obtained by one independent research laboratory on Molybdenum-Chromium Alloyed Gray Iron cast by a large Midwest foundry, using untreated and FERROCARBO-treated iron of identical chemistry.

WRITE FOR MORE INFORMATION on how FERROCARBO produces more machinable iron regardless of metal composition. Ask for booklet A-1409, Electro Minerals Division, The Carborundum Company, Niagara Falls, New York.

Chemical Analyses	Untreated	Ferrocarbo® Treated
TC	3.36	3.38
Si	2.17	2.19
P	0.12	0.12
Mo	0.60	0.41
Cr	0.39	0.51
CE	4.08	4.11
Cutting speed (ft./min.)	315	315
Feed (in./rev.)	.009	.009
Depth of cut (in.)	.062	.062
Wear Land (in.)	.015	.015
Vol. of metal removed (cu. in.)	3.3	4.7
Percent improvement		42.5%



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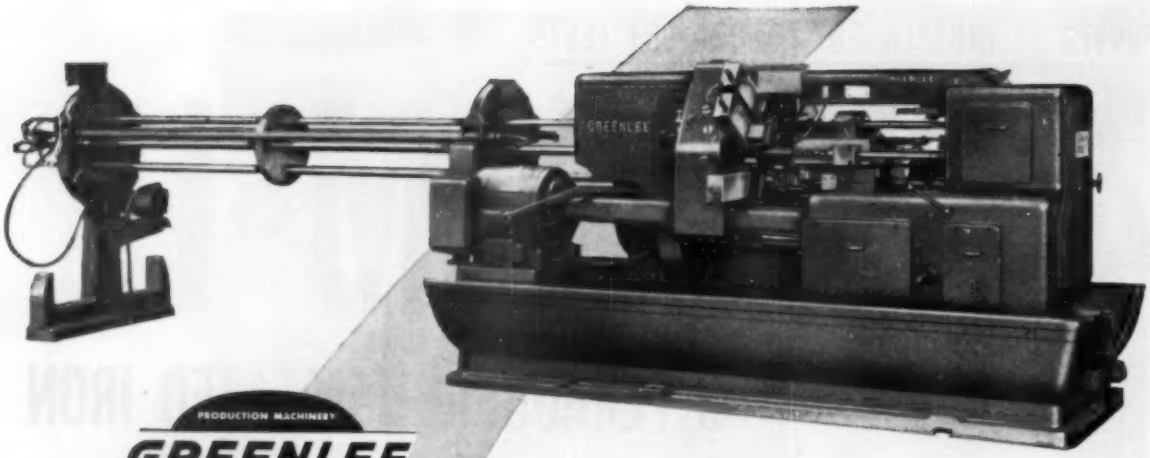

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- **Easily Adapted to Multiple Feedouts**
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- **Eliminates Stock Scoring**
- **Reduces Stock Reel Noise**
- **Eliminates Stock Pushers**
- **Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

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Burrs are efficiently removed, edges and surface junctures are precision blended to microinch tolerances. Osborn Power Brush Finishing time: 3 minutes.

5 times as fast

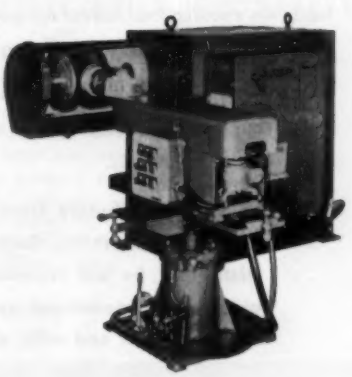
OSBORN Brushamatic® saves 180 hours a month

ALL edges and surface junctures of this aircraft component must be blended to microinch specifications to eliminate stress concentrations and ultimate fatigue cracks.

Previously, this surface blending had to be done by hand . . . requiring considerable skill and time. Still, results were inconsistent . . . rejects were high, calling for reworking and re-inspection.

Using Osborn's Brushamatic® Machine, the operation that once took 15 minutes is now done in 3 minutes . . . a 400% *increase in output per man—and a saving of 180 hours a month.*

This kind of precision finishing can save money on many types of products you manufacture today. An **O**sborn **B**rushing **A**nalysis, made in your plant, will show you how. Write us for details—and for your copy of the 100-page Osborn Catalog 210-C . . . and for the 20-page Brushamatic® booklet. *The Osborn Manufacturing Company, Dept. C-63, Cleveland 14, Ohio.*



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The man shown above is cleaning a Skinner Solenoid Valve. He has disassembled it by hand without removing it from the line. Simplicity of design makes this simple maintenance and service feature possible. The design of Skinner valves is such that coils and other parts are interchangeable and easily, quickly replaced. They are readily available, too — reducing the stocking of spare parts to a minimum.

Skinner Solenoid Valves are made of the very finest materials available and contain only two moving parts. Their joints are heli-arc welded on special electronically controlled equipment. Their coils, manufactured to UL standards, will operate for years without burnout. Their positive spring returns eliminate sticking. And they have no packing to wear out and cause leakage.

If you are looking for solenoid valves that will give you longer trouble-free performance, look to Skinner valves. For complete information on Skinner's line of 2-, 3- and 4-way valves, write us or contact a Skinner representative. Write Dept. 300.

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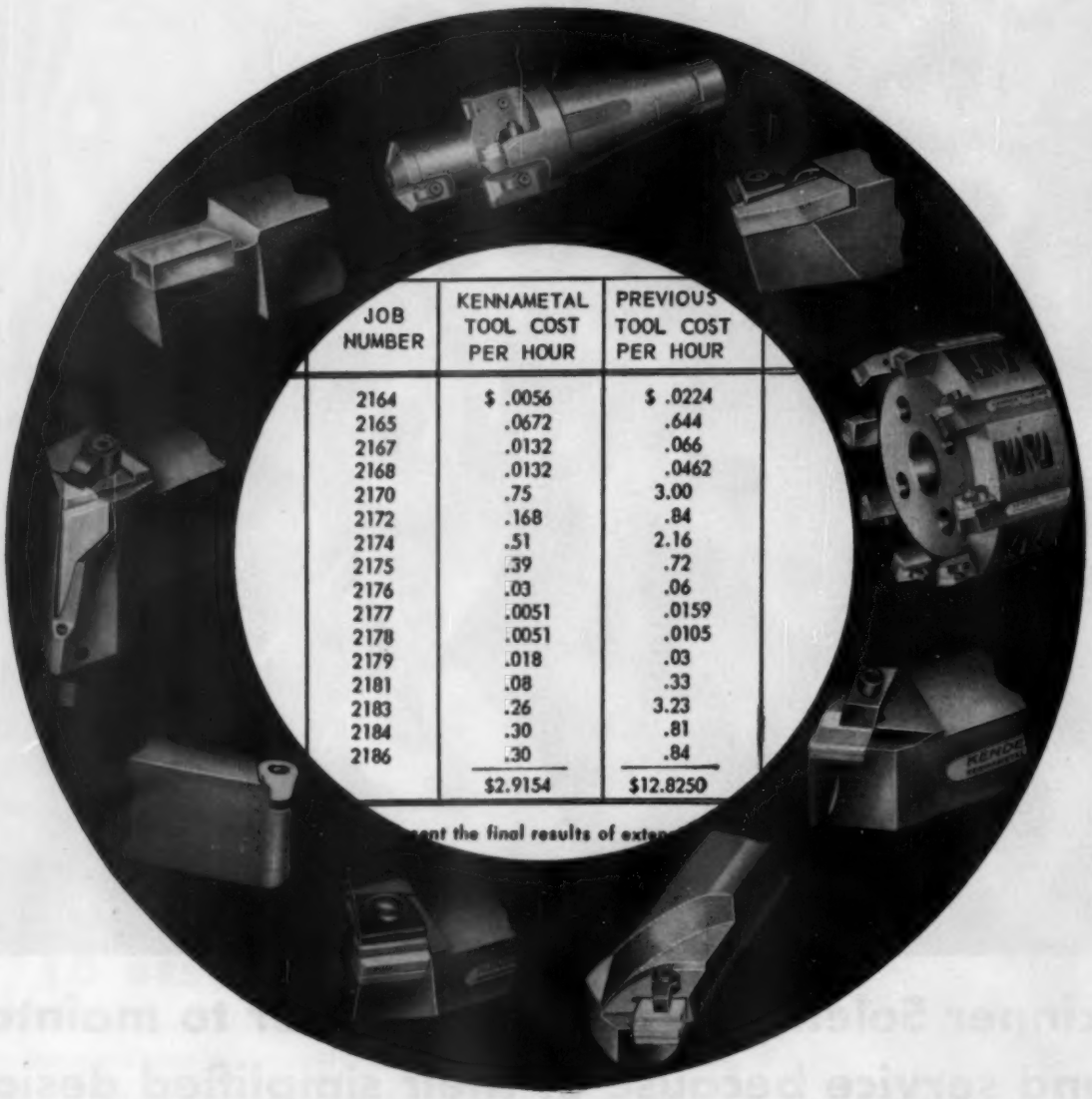

JOB NUMBER	KENNAMETAL TOOL COST PER HOUR	PREVIOUS TOOL COST PER HOUR
2164	$ .0056	$ .0224
2165	.0672	.644
2167	.0132	.066
2168	.0132	.0462
2170	.75	3.00
2172	.168	.84
2174	.51	2.16
2175	.39	.72
2176	.03	.06
2177	.0051	.0159
2178	.0051	.0105
2179	.018	.03
2181	.08	.33
2183	.26	3.23
2184	.30	.81
2186	.30	.84
	$2.9154	$12.8250

...ent the final results of exte...

It took KENNAMETAL* Tooling—*plus* KENNAMETAL Tool Engineering Service—to get these results!

There's nothing much that words can add to the story told by the comparative cost figures above. On sixteen separate applications, Kennametal tool cost per hour (center column) totaled $2.9154—less than one-fourth as much as the $12.8250 cost for tools previously used (right hand column).

On this basis, the Kennametal tool cost of $17,490 per year cut previous expense by $59,460!

It takes a combination of quality tools and *scientific* service to produce results like this. Kennametal has built its business upon this combination.

A Kennametal Tool Engineer will work with your personnel, in analyzing various machining jobs to get the best results on each operation. The extensive selection of standard Kennametal tooling usually provides the exact tool needed to handle the work . . . if not, he can make the proper recommendations.

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We will be glad to give you full information on how Kennametal tools and Kennametal service can help you. Just write, outlining your particular problem, to KENNAMETAL INC., Latrobe, Pennsylvania.

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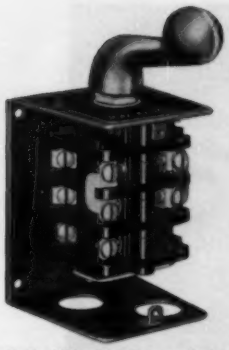
INDUSTRY AND KENNAMETAL ...Partners in Progress

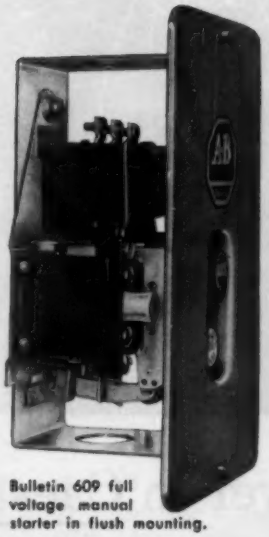


Bulletin 806 pilot drum switch—10 ampere size—with cover removed to show terminals.

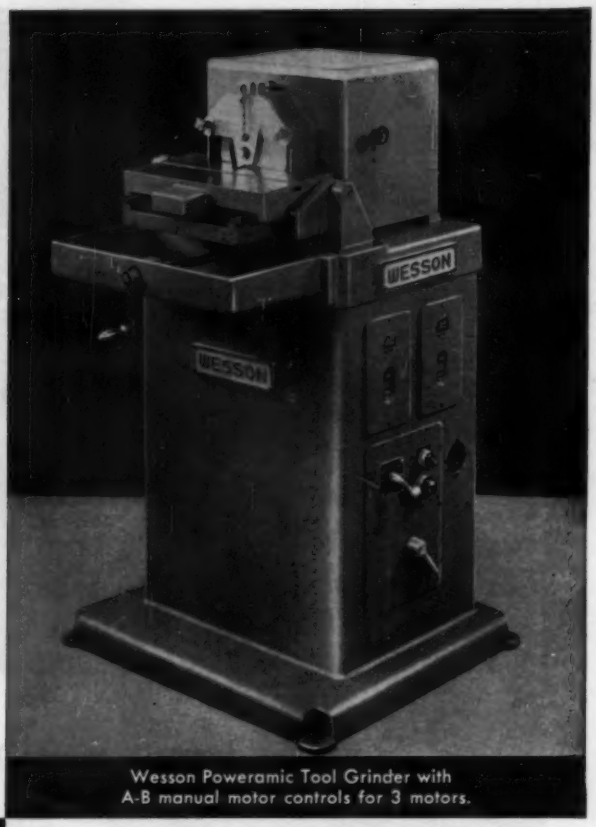
Bulletin 894 manual disconnect switch in base of grinder.

Bulletin 800T oiltight selector switch for Hand-Off-Auto control.

Bulletin 800T transformer type pilot light—550 volts, maximum.



Bulletin 609 full voltage manual starter in flush mounting.



Wesson Poweramic Tool Grinder with A-B manual motor controls for 3 motors.

Close-up of control panel of Wesson Poweramic Tool Grinder with flush type motor controls.

Streamline your motorized machines with Allen-Bradley flush type controls

By using flush type control units, the Wesson design engineer not only succeeded in grouping the controls for the three motors within easy reach of the operator, but in streamlining this Poweramic tool grinder, he gave it added sales appeal.

The flush mounted manual starters fit into recesses just above the flush mounted drum switch. The manual disconnect switch near the bottom of the machine base controls the power supply of the entire machine.

Flush type control equipment provides a wonderful opportunity for designing compact, good-looking machines. Follow this modern trend—and increase your sales. Let us send you our latest Handy Catalog giving full data on the Allen-Bradley line. Write, today.

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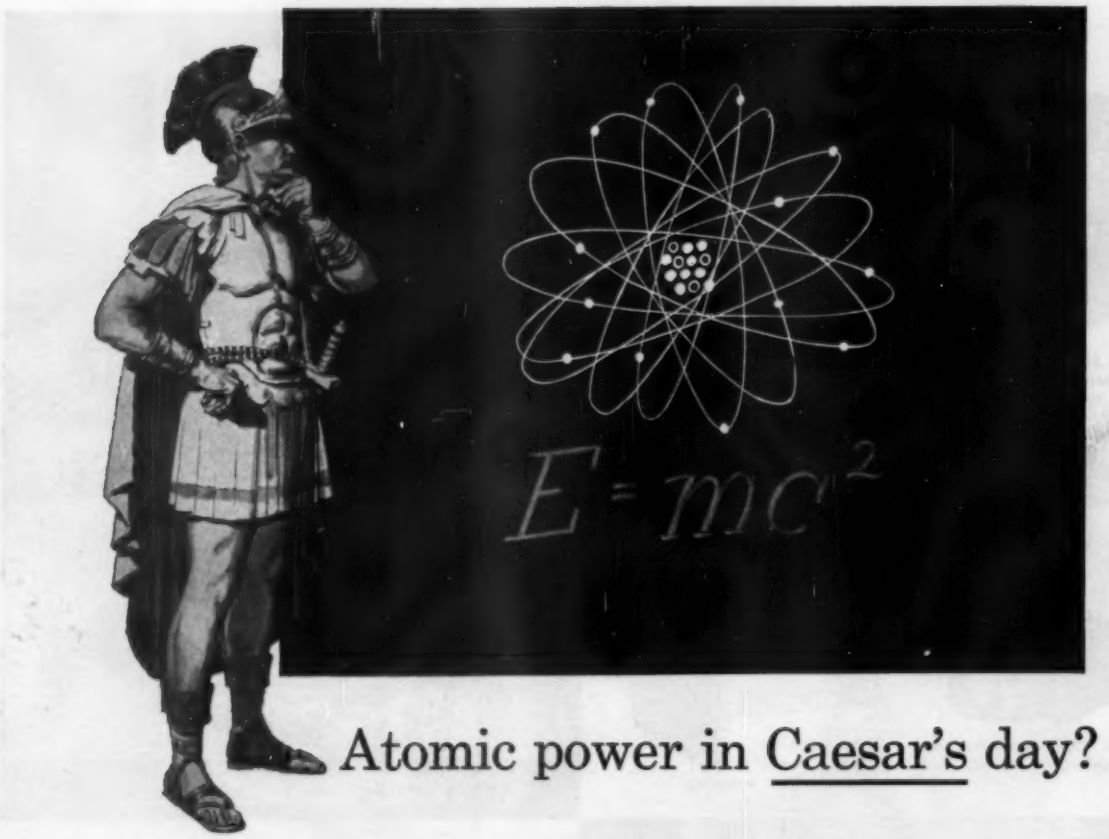

Atomic power in Caesar's day?

Certainly!

It was there, in the ground, in the air and water. It always had been. There are no more "raw materials" today than there were when Rome ruled the world.

The only thing new is knowledge . . . knowledge of how to get at and rearrange raw materials. Every invention of modern times was "available" to Rameses, Caesar, Charlemagne.

In this sense, then, we have available *today* in existing raw materials the inventions that can make our lives longer, happier, and inconceivably easier. We need only *knowledge* to bring them into reality.

Could there possibly be a better argument for the strengthening of our *sources* of knowledge—our colleges and universities? Can we possibly deny that the welfare, progress—indeed the very *fate*—of our nation depends on the quality of knowledge generated and transmitted by these institutions of higher learning?

It is almost unbelievable that a society such as ours, which has profited so vastly from an accelerated accumulation of knowledge, should allow anything to threaten the wellsprings of our learning.

Yet this is the case

The crisis that confronts our colleges today threatens to weaken seriously their ability to produce the kind of graduates who can assimilate and carry forward our rich heritage of learning.

The crisis is composed of several elements: a salary scale that is driving away from teaching the kind of mind *most qualified* to teach; overcrowded classrooms; and a mounting pressure for enrollment that will *double* by 1967.

In a very real sense our personal and national progress depends on our colleges. They *must* have our aid.

Help the colleges or universities of your choice. Help them plan for stronger faculties and expansion. The returns will be greater than you think.

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7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6. Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

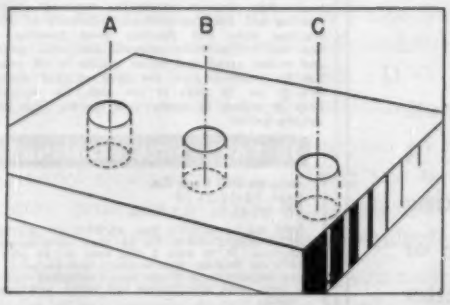

Fig. 1. In grinding three holes to size, A and B are roughed to within .001"—.002", and C within about .005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 738 Union Ave., Bridgeport 7, Conn.

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From the *American Machinist* Library of Tips for Top Shop Men

BE sure your machine tools don't spend most of their "working" day as layout tables. A machine tool earns its keep only when it is cutting metal. Jobs can be set up on a surface plate or bench by someone else—frequently someone better at setup than the machine operator.

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Senior Associate Editor, *American Machinist*
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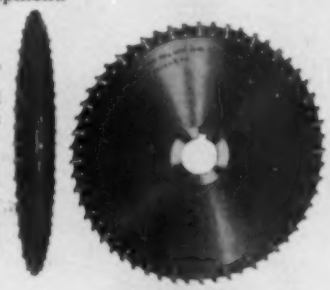
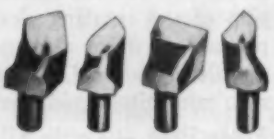
Free cutting, for slots and keyways. Any width from 3/16"; diameters from 3" up. Drop-forged blades, adjustable to maintain width if desired. Also made with full radius, and in interlocking style as well.



(A) End Mill. (B) Comb. Boring and Facing Mill. Both are made with tapered, serrated blades, adjustable to hold diameters.

Apex offers milling cutters for many jobs. Above is shown one that takes a big chip fast! Made in diameters from 8" to 24". Cutters also available for lighter work of various types.

Shown at left is one of the famous Apex Shankless, Adjustable, Serrated, Single-Point Tools. Holders are available for every metal-removing job, with numerous standard-shape tool bits to choose from.



Apex bits of the type shown above will fit most standard tool holders.

Apex holders for round-shank tool bits are available in all sizes for all jobs. The tools are furnished ground, ready to use.

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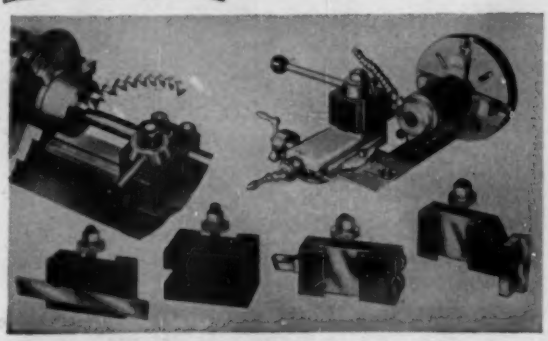

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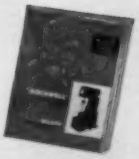

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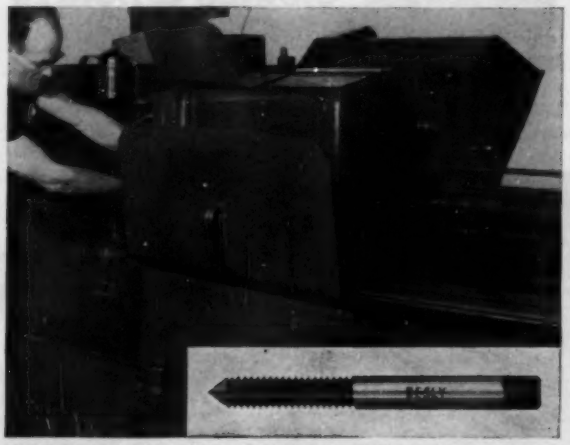

"ROLLING" THREADS IN COPPER—At Steel Industries, Inc., Crawfordsville, Ind., an automatic screw machine is being set up to size, bore and thread 1500 small, difficult-to-tap copper parts per hour. The Besly ¼-28" "X-Press" fluteless tap, shown, is used. H. M. Oshry, Vice-Pres., states, "Besly 'X-Press' Taps made it possible to use this high production method successfully. We get stronger, better, rolled (pressed, not cut) internal threads with no burrs or chips — longer tool life and fewer rejects."

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CARBIDE TOOLS IN ACTION—Cast steel truck wheels made by Gunnite Foundries Corp., Rockford, Illinois, are rough bored with a Besly BL-12-B5 Standard Carbide Tipped Tool, arrow 1, removing ⅛" to ⅜" of stock. On the same turret lathe a second Besly AL-12-B5 Standard Carbide Tipped Tool, arrow 2, semi-finish bores, removing .030" stock. Metal removal is at 200 S.F.M. at .016" feed. Besly's Engineering Service helped to achieve this efficient, low-cost metal removal set-up.

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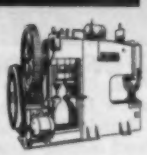

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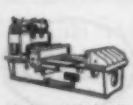

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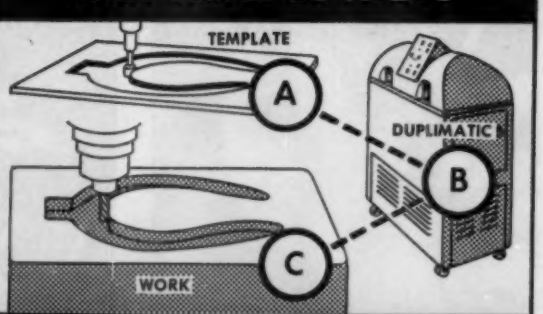

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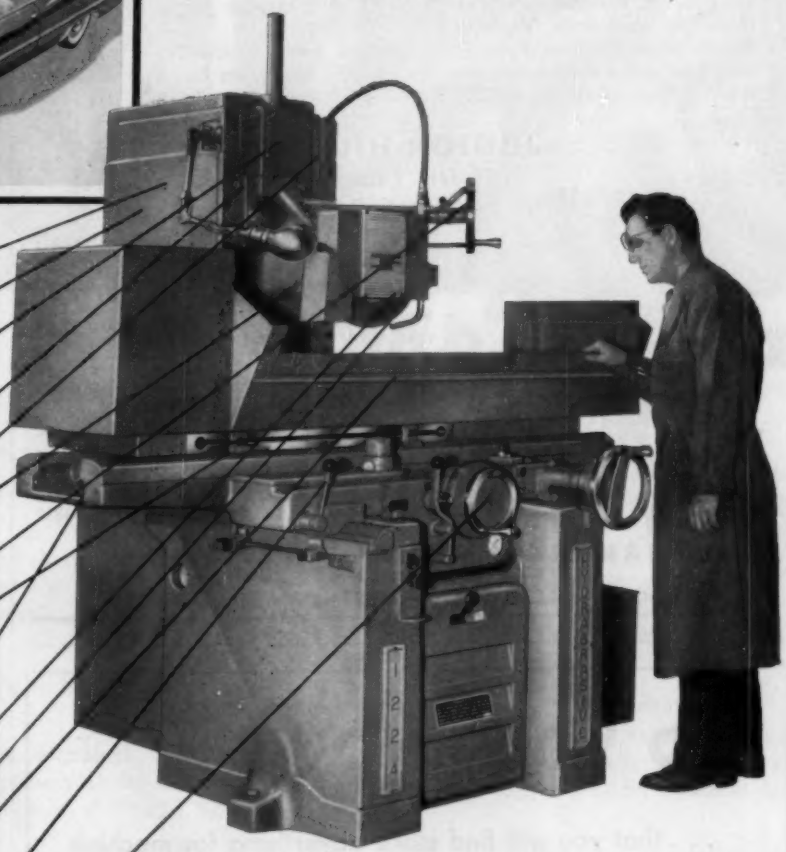

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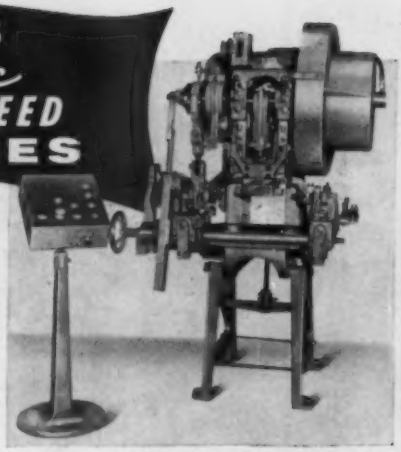

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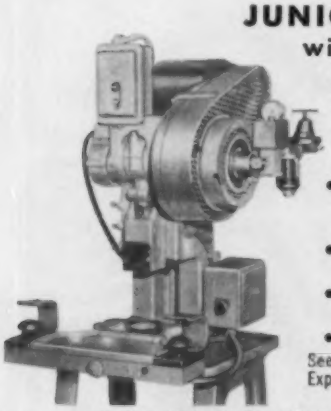

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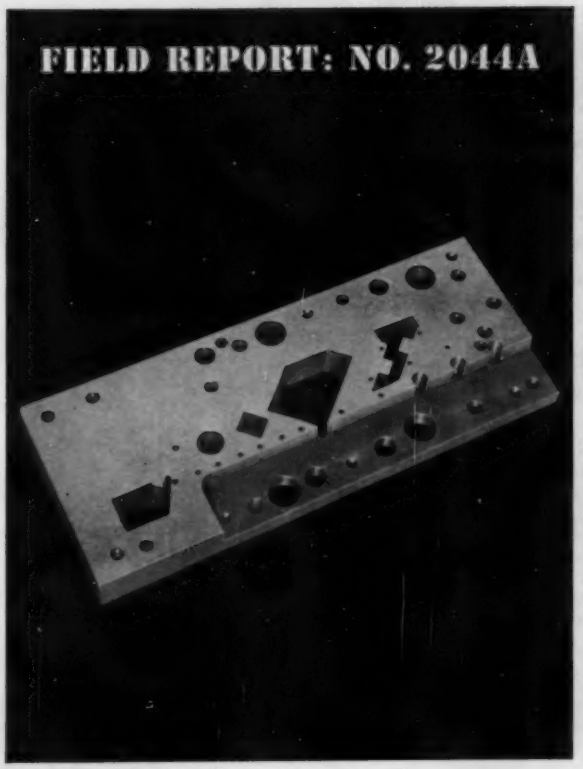

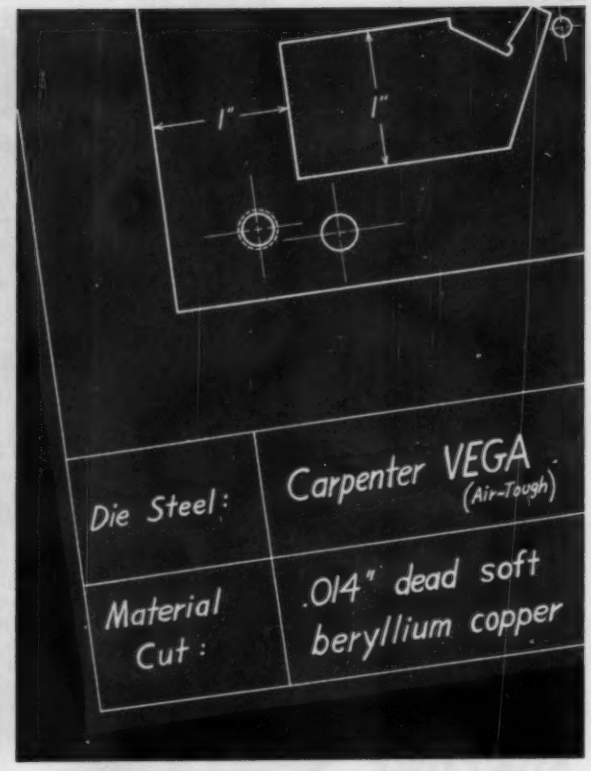

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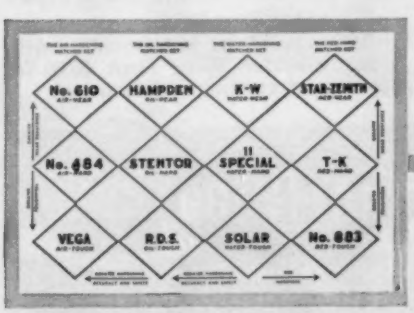

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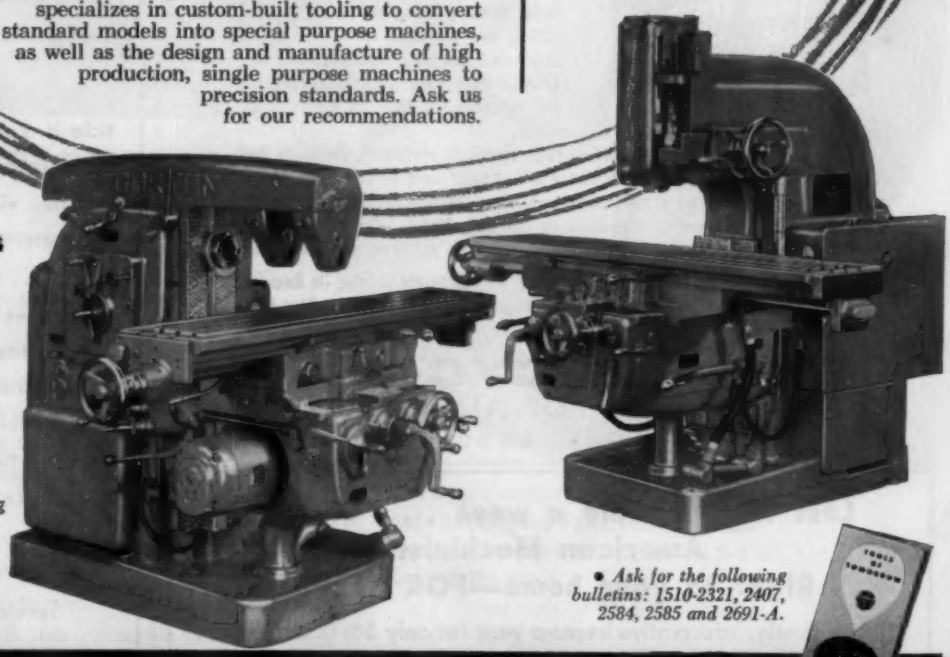

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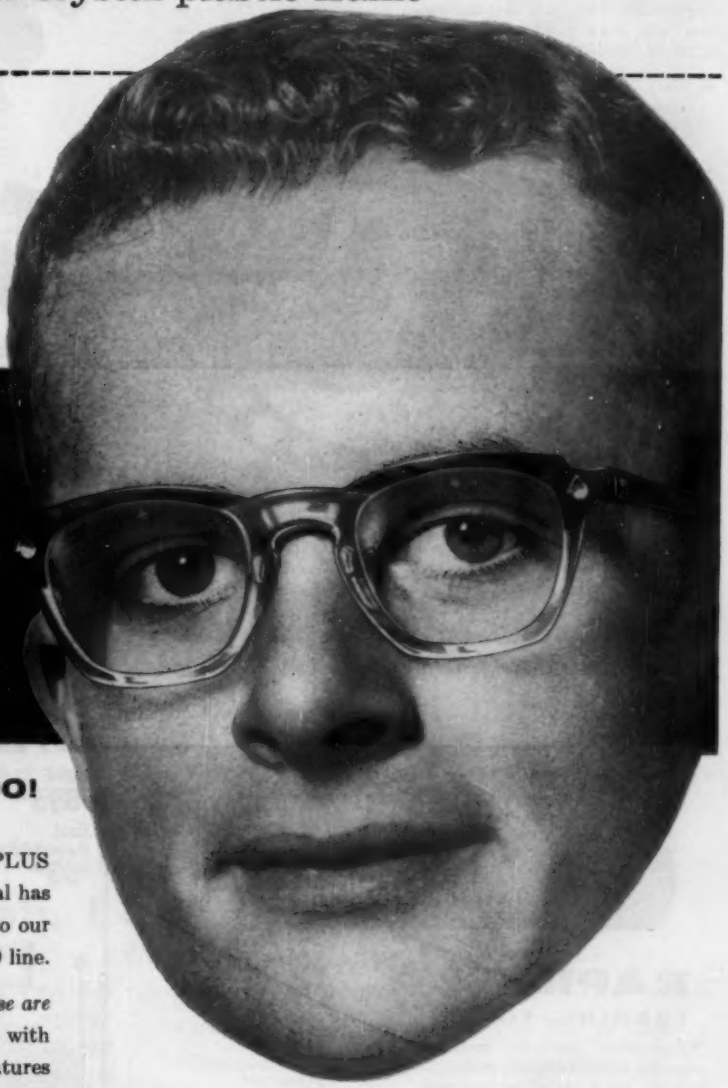

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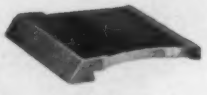

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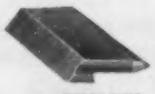

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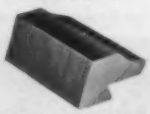

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A HEAVIER BARKER MILL WITH LARGER WORKING SURFACES FOR MACHINING BIGGER PARTS. TAKES #30MM STANDARD ADAPTERS. WILL ACCOMMODATE MOST STANDARD INDEXING HEADS, VISES, AND SPECIAL ACCESSORIES.

Heavy Duty ¾ H.P.—Ball Bearing, totally enclosed Motor. HEAD TRAVEL—6 inches, TABLE TRAVEL—10 inches. SADDLE TRAVEL—4½ inches. MICROMETER FEED SCREWS can be installed on any travel at slight extra cost. TABLE has large working surface, 6" wide by 20" long.

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COOLING SYSTEM: Available at extra cost.

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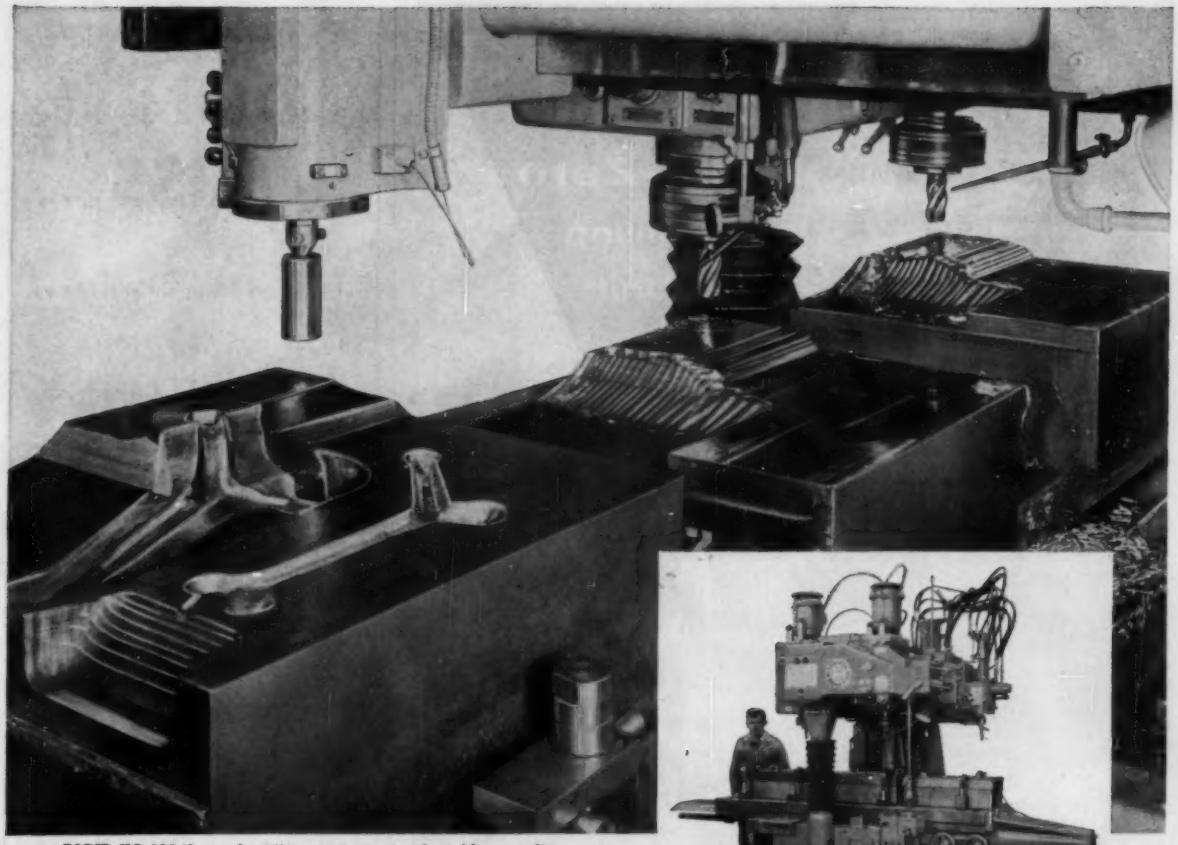

RIGID KA-200/2 rough milling two steering knuckle arm dies

RIGID Model KA-200/2

Rigid *Provides—*

Fully Automatic Die-Sinking Finer Finish, Less Bench Time

A great improvement in accuracy and surface finish—with no increase in cutting time—is possible with these RIGID Die-Sinking and Hydrocopy Milling machines. Fully automatic machining permits a drastic cut in operator's supervision. Accuracy and high surface finish keep bench time to an absolute minimum—in many cases only polishing is necessary. A completely enclosed frame gives the machine tremendous rigidity to handle extremely heavy cuts. The RIGID is available in three sizes with 1, 2, 4 or 6 spindles. Largest copying area is 23⅝" x 39⅞".

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- Normal Working Accuracy of ± .002" or Closer
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- Reverse Image Attachment
- Automatic 360° Profiler With Depth Control (Working Accuracy ± .002")
- Change-over from Transverse to Longitudinal Copy-Milling in Seconds

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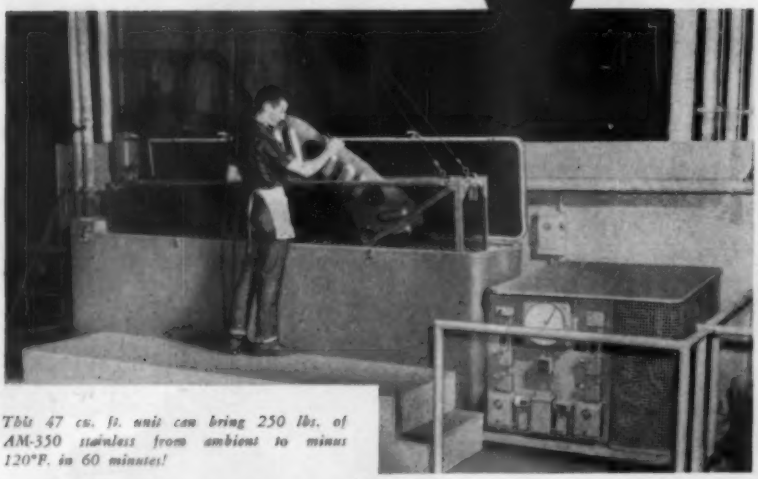
STAINLESS STEEL

. . . with this
Cincinnati
Sub-Zero
Chilling
Unit



This 47 cu. ft. unit can bring 250 lbs. of AM-350 stainless from ambient to minus 120°F. in 60 minutes!

Stabilization of austenitic stainless steels and tools is accomplished quickly and safely at North American Aviation with a model 3SR-120-47 Cincinnati Sub-Zero Chilling Machine. Tailored to the specific application, this new 47 cu. ft. model completes the transformation from austenite to martensite without warpage, excessive scaling or distortion . . . produces high impact steel with good corrosion resistance.

The model 3SR-120-47 will be used extensively to eliminate retained austenite in the aircraft industry's "new" steels. Rocket and missile steel, for example, must retain hardness and dimensional stability at elevated temperatures.

Cincinnati Sub-Zero, a pioneer manufacturer with more than 16 years' experience in the Design, Construction and Application of Low Temperature Equipment, can custom-build a unit to meet your specifications.

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See "Index to Advertisers" for location of section.

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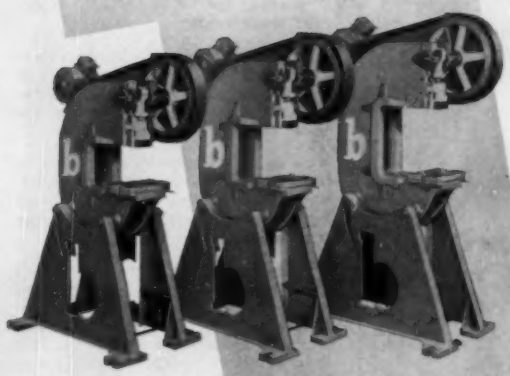
New York 36, N. Y.

6 NEW "PRODUCTION-BUILDERS" from benchmaster

Benchmaster, the world's largest manufacturer of small punch presses and milling machines, is constantly expanding its product line with new machines for more efficient production. Literature on the following Benchmaster equipment is available giving complete details. Write for your copies today!



NEW BENCHMASTER 10 TON DEEP THROAT PRESSES
Series 100

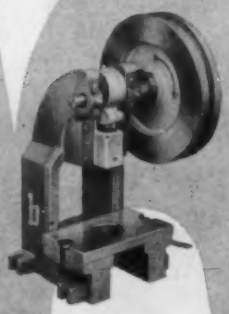
Available in 3 new models with standard strokes of 1¼". Other strokes available from 1½" to 3". Center of slide to frame 12". Shut heights are obtainable from 7" to 13" depending upon model number and stroke length desired.

OTHER BENCHMASTER MACHINES

PRESSES: Benchmasters are available in 2, 5, 8 and 10-ton capacities in the following types: Plain OBI, Deep Throat, Fixed-Bed Gap Frame, Back Geared, Half-Press and Multiple Ram.

MILLS: Benchmasters quickly convert from horizontal to vertical milling by exchanging spindle quill assemblies. Precision performance at minimum cost!

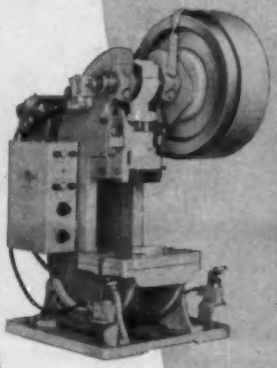
ACCESSORIES: For Presses and Mills; Roll Feeds, Cage Guards, Floor Legs, Rotary Tables, Swivel Vises, Arbors, Collets, Pedestals, etc.



BENCHMASTER 2 TON FIXED-BED GAP FRAME PRESSES

A new Benchmaster with a 4½" column spacing for feeding foil and other wide materials! For fast, efficient light manufacturing or assembly. Typical Benchmaster quality...adjustable gibs, improved sliding key-type clutch, husky frame, replaceable bronze bearings, etc.

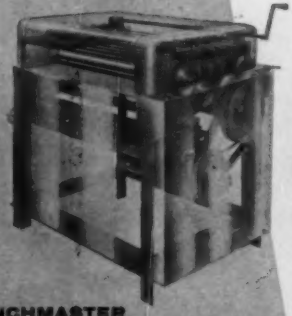
BENCHMASTER ELECTRO-MAGNETIC CLUTCH



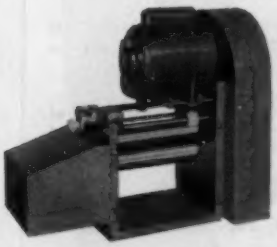
Insures instant pickup or disengagement at any portion of the stroke. Permits application to flying cut-off operations or automation of several presses from a single control source. Smooth and relatively noiseless, no sliding keys, no breakage hazards due to shock, excellent safety. Controls for manual, foot, 2-button hand, remote or automatic operation.

NEW BENCHMASTER STRAIGHTENING MACHINES

Now furnished in several series with choice of 9 or 11 rolls for handling all types of coiled stock from soft aluminum to tempered steels. Roll widths up to 36". Thicknesses up to .200". All models equipped with pinch rolls at feed or feed and discharge ends. Also available with or without magnetic clutch and brake.



NEW BENCHMASTER AUTOMATIC MOTORIZED FEEDS



Equipped with new Benchmaster Electro-Magnetic Clutch and Brake, can be used with presses, shears, etc. Built-in electric measuring device feeds any required length before automatic shut-off. Also available with external microswitch and fixed stop for automatic shut-off. Roll widths up to 36", thickness capacity ⅛". Other specifications on special order.

BENCHMASTER KOIL-KRADLES

Big production booster for all machines feeding coil stock. Supplies a slack loop from which any machine can freely draw without pulling against the weight of a heavy coil. Equipped with Benchmaster's Variloop control which eliminates constant motor starts and stops, insures longer life. Can be supplied in Koil-Kradle Straightener Combinations.

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Weight	lbs. 28500

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Height of Centers 8⅝ to 22 in.

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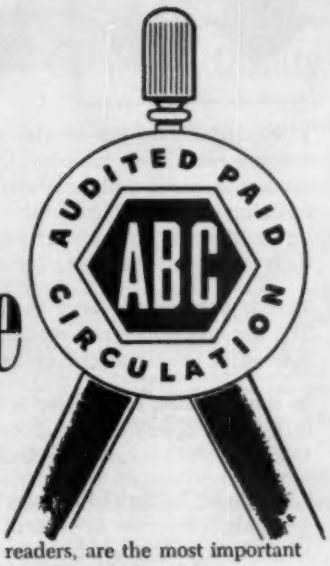

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THE SURPLUS MACHINERY MARKET

• **Reports across the country** show a decided pickup in an already healthy rebuilding business. One top dealer reports that many big companies in several metalworking fields have come in with big rebuilding orders—an indication that even the blue chip metalworking outfits are going in for extensive rebuilding programs to keep their old machines going for some time to come.

This is particularly true in the general equipment classifications. The big companies are sending in six or seven machines at a time instead of the usual one or two.

In consequence, one dealer is operating his rebuilding business six days a week, has even put some of his used machines into storage to create more space for rebuilding.

"A little bit better than it was during the summer" just about sums up dealer reactions to current business conditions. The pickup, for what it is worth, is characterized by one as "not worth any flag waving yet."

Sales on dealer inquiries are still very low—some figure them at less than 1%—with dealers asking each other for prices mostly to keep a line on the market.

Otherwise the ratio of sales to inquiries shows a slight improvement, but inquiries haven't picked up appreciably. At least one used machinery dealer has said recently that if the market doesn't improve decidedly soon, you'll see some major price breaks.

No matter how you look at it, the fall pickup hasn't lived up to hopes and expectations. Prices have softened here and there. Even the auctions are finding the going a bit rougher, with most bids running less than what they have been.

Prices are holding up well on good late-model machines, and quoting prices on others are steady, but closing prices are being pushed lower by increased selling competition, with the result that most sales are now being made strictly on price.

Apparently the ups and downs of the stock market and general uncertainty over future business conditions have scared off some potential buyers.

Result is that many dealers are changing their tunes over prospects for the fourth quarter. All summer long they've been saying "just wait until things get going in the fall—the fourth quarter should make up for the rest of the year." But now the dealer who looks for a rosy fourth quarter that will throw his books into the black is a rare bird.

• **Trend among the large aircraft producers,** as reported from the West Coast, is to lease used machinery on a short-term basis rather than to sink capital into either new or used machinery until the defense situation clears up.

The leases run four to six months, reflecting the uncertainty of the aircraft industry as to what the future holds in store. Another indication of the instability of the aircraft industry at the moment is the difficulty of moving used lathes, milling machines, turret lathes and screw machines out there.

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GIDDINGS & LEWIS #25T; 2½" bar; type late
GIDDINGS & LEWIS #340T; 4" bar; New 1953
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GIDDINGS & LEWIS 25 RT; 2½" Bar; late type
HEALD #49 double end Precision Borer; late
LANDIS #35; 3½" bar; M.D.
SELLERS 4" bar; table type; late type
SELLERS 5" bar; table type; late type
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BULLARD 36"x30" Man-au-trol Spacer Unit; New 1950
BULLARD 8", 8 spin. Type D Multaumatic late
BULLARD 16", 6 spin. Type D Multaumatic; late
BULLARD 24" Vertical Turret; spiral dr.; late
BULLARD 36" Vertical Turret; spiral dr.; late
COLBURN 62" heavy duty; M.D.
COLBURN 72" heavy duty; M.D.
GERMAN NILES 41-51" Vertical Turret and side head; New 1956

BROACHES
AMERICAN Model H-20-60 Horiz.; late type
CINCINNATI 1-30 Vertical Hydro; Duplex; late
COLONIAL Model VGI-10-48 Vertical; late type
LAPOINTE Model SRV 10-54 Vertical; late type
LAPOINTE Model SRV 15-66 Vertical; late type

DRILLS
BARNES #262 box column; late type
BARNES #H3 Hydram; hydraulic; late type
CINCINNATI BICKFORD 24" "Super Service"
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LELAND & GIFFORD #1 LMS single spindle sensitive; late type
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LELAND & GIFFORD #2LMS single spindle sensitive; late type
LELAND & GIFFORD #2LMS 2 spindle sensitive; late type
LELAND & GIFFORD #2LMS 3 spindle sensitive; late type

DRILLS—DEEP HOLE
BARNES #420, 2 spindle; late type
PRATT & WHITNEY #1½B x 50" Rougher; late
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NATCO Model C5; 10 spindles; Adjustable; late type
NATCO Model E5; 12 spindles; late type
NATCO Model 4BL; 26 spindles; Adjustable; 1" upper joints; late type

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AMERICAN 4' arm 11" col. Triple Purpose.
AMERICAN 6' arm 17" Col. Hole Wizard; late
AMERICAN 7' arm 16" col. Triple Purpose
AMERICAN 4' arm 11" col.; motor on arm; triple purpose; M.D.
AMERICAN 6' arm 17" col. "Hole Wizard"
CARLTON 6' arm 19" col.; motor on arm
CARLTON 6' arm 19" col. Plain; low hung dr.
CIN. BICKFORD 24" Super-Service; late type
CIN. BICKFORD 28" Super-Service; late type
CIN. BICKFORD 2½" arm 7½" col. Super-Service H.S.; late
CIN. BICKFORD 4' arm 9 col. Super-Service
CIN. BICKFORD 6' arm 15" col. Univ.; oil groove base
CINCINNATI BICKFORD 2½' arm 7½" col.; "Super Service"; late type
CINCINNATI BICKFORD 4' arm 9" col.; "Super Service"; double end base; late type
CINCINNATI BICKFORD 5' arm 13" col.; "Super Service"; M.D.
FOSDICK 6' arm 17" col.; H.S.; late type
FOSDICK 6' arm 17" col.; Hydraulic; late
G&P 3' arm 10" col.; New 1953
MORRIS 3' arm, 11" col., "Mor-Speed"; late
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3" Straight Bevel Gear Generator; 4-7/16" P.D., 8 D.P.; late
3" Spiral Bevel Gear Generator; 4-7/16" P.D.; 12 D.P.; late
#6 Straight Bevel "Revacycle"; 450 D.P.; late
#7 Hypoid Cutter Sharpener; max. dia. 6" R or L hand; late
#7A Gear Generators; late type
11" Straight Bevel Gear Generator; M.D.
12" Straight Bevel Gear Generator; fully auto
#12 Tool Sharpener; late type
12" Spiral Bevel Cutter Sharpener; max. dia. 16" late
#16 Hypoid Gear Generator; 2½ D.P.; Production Type; late
15" Spiral Cutter Grinder; motor drive
15" Spiral Bevel Gear Generator; max. dia. 19¼"; 3 D.P.; M.D.
25" Spiral Bevel Gear Generator; max. dia. 24"; 1½ D.P.; M.D.
24" Straight Bevel Gear Planer; max. dia. 28"; 1½ D.P.; M.D.
37" Spur & Straight Bevel Gear Planer; max. dia. 43"; 1 D.P.; M.D.
54" Spur & Straight Bevel Gear Planer; max. dia. 60"; 3½ D.P.; M.D.

GEAR EQUIPMENT—HOBBING
BARBER COLMAN Type A; cap. 12"x12"; 3 D.P.; with differential; late
BARBER COLMAN Type S Auto.; 1" dia., brass 24 D.P., steel 32 D.P.; late
BARBER COLMAN Type T, 12"x12" cap., 3 D.P.; with differential; late
BARBER-COLMAN Type V; 8-10, Vert. cap. 8"
BARBER COLMAN #17, Cap. 8"; 2½ D.P.; 5¾" hole thru spindle; M.D.
GOULD & EBERHARDT #8H Univ.; cap. 12"; 4 D.P.; heavy duty; M.D.
GOULD & EBERHARDT #24H Univ.; cap. 27"; 3½ D.P.; late type
GOULD & EBERHARDT #24H Univ.; extended hob spindle
LEES BRADNER 7A-8 Spdle. Rotary Hobbers
NEWARK #5 for helical worm wheels & spur gears

GEAR SHAPERS—FELLOWS
FELLOWS 3" Fine Pitch, High Speed; late type
FELLOWS Type 645-A-3 High Speed; late type
FELLOWS #01A High Speed; late type
FELLOWS #612 High Speed; late type
FELLOWS #624 High Speed; late type
FELLOWS Type 6Z2 High Speed; late type
FELLOWS #7 High Speed; late type
FELLOWS #72 High Speed; late type
FELLOWS #712 High Speed; late type
FELLOWS #715 High Speed; late type
FELLOWS #715A High Speed; late type
FELLOWS #7A High Speed; late type
FELLOWS #7125 High Speed; late type
FELLOWS #725A High Speed; late type
FELLOWS #24M Involute Measuring Instrument; late type
FELLOWS #13L5 Lapper; late type

GEAR CUTTERS—GLEASON
GLEASON #1 Surface Hardness Tester; late
GLEASON 3" Straight Bevel Generator; late
GLEASON 3" Spiral Bevel Generator; late type
GLEASON #4 Angular Hypoid Tester; late
GLEASON #7 Hypoid Cutter Sharpener; late
GLEASON #12 Tool Sharpener; late type
GLEASON #7A Hypoid Generator; late type
GLEASON 12" Straight Bevel Generator; late
GLEASON 12" Straight Bevel Rougher; late
GLEASON Cutter Truing Device; late type
GLEASON #14 Hypoid Gear Grinder; late
GLEASON 15" Spiral Cutter Grinder; late type
GLEASON 15" Hypoid Generator; M.D.
GLEASON #15A Hypoid Pinion Rougher; late
GLEASON #16 Hypoid Generator; late type
GLEASON #17 Combination Tester and Lapper; late type
GLEASON 18" Bevel Gear Tester; M.D.
GLEASON 24" Straight Bevel Gear Planer; M.D.
GLEASON 25" Spiral Bevel Generator; late
GLEASON 37" Straight Bevel Gear Planer; M.D.
GLEASON 54" Straight Bevel Gear Planer; M.D.

GEAR CUTTERS—MISCELLANEOUS
BILGRAM 6" Bevel Gear Generator
BILGRAM 16" Bevel Gear Generator
BARBER COLMAN Type A Hobber with diff.
BARBER COLMAN Type S Hobber; late type
BARBER COLMAN #3 Hobber "Standard"
BARBER COLMAN 16-11 Type T Hobber; late
BARBER COLMAN 8-10 Type V hobber; late
BARBER COLMAN #17 Hobber; 5¾" hole thru spindle; M.D.
BROWN & SHARPE #13 Gear Cutter; M.D.
DETROIT Model GG-35 Gear Grinder; late type
GOULD & EBERHARDT #8H Hobber; M.D.
GOULD & EBERHARDT #12H Hobber; M.D.
GOULD & EBERHARDT #18H Hobber; M.D.
GOULD & EBERHARDT #24H Hobber; late
GOULD & EBERHARDT #36BM 3 spindle Rougher; M.D.
GOULD & EBERHARDT #36BT Rougher; M.D.
LEES BRADNER Model 7A, 8 spindle Hobber; late type
MICHIGAN Model 854 Gear Shaver; M.D.
MICHIGAN Model 862-24-A Gear Shaver; late
NEWARK 72" Gear Cutter; M.D.
PRATT & WHITNEY 10" Gear Grinder; late
STAEHELY Model SH250 Hobber; late type

GRINDERS—INTERNAL
BRYANT #5 Hydraulic; late type
BRYANT #18-38 Hydraulic; late type
BRYANT #24-L-26 Hydraulic; late type
HEALD #72A3 Hydraulic; late type
HEALD #72A5 Hydraulic; late type
HEALD #78 Internal CENTERLESS; late type
HEALD #81 Internal CENTERLESS; late type
HEALD #81 Chucking; late type

GRINDERS—CYLINDRICAL PLAIN
BROWN & SHARPE 10"x36" cc Model 22; late
CINCINNATI 4"x12" cc Hydraulic; late type
LANDIS 6"x12" cc Type H; late type
LANDIS 6"x18" cc Type C; late type
LANDIS 10"x36" cc Type DC Hydraulic; late
LANDIS 10"x72" cc Type DC Hydraulic; late
LANDIS 10"x96" cc Type C Hydraulic; late
LANDIS 16"x216" cc Type B; late type
LANDIS 25"x72" cc Type D CRANKPIN; late
LEMCO 22"x84" cc CRANKSHAFT; late type
NORTON 6"x18" cc Type C; late type
NORTON 6"x30" cc Type C; late type
NORTON 10"x18" cc Type C Hydraulic; late
NORTON 16"x48" cc Type C Hydraulic; late
NORTON 16"x72" cc Type C; late type
NORTON 18"x72" cc Type C; Autopart Regrinder; late type
VAN NORMAN #418, 4"x18" cc—NEW.

GRINDERS—SURFACE
ABA 8"x24" cc Hydraulic; New 1953
ARTER #3, 12" Rotary; late type
BROWN & SHARPE #2, 6"x18"; late type
HANCHETT 36"x120" cc Face Wheel; M.D.
HEALD #22; 12" chuck; M.D.
HEALD #25A Rotary; 30" chuck; M.D.
MATTISON 14"x16"x80" Hydraulic; late type
MATTISON 20"x24"x72" Hydraulic; late type
NORTON 6"x18" cc vertical spindle; late type
NORTON 6"x18" horiz. spindle; late type
PRATT & WHITNEY 14"x36" cc ver. spindle

GRINDERS—UNIVERSAL
BROWN & SHARPE #1, 10"x20" cc; late type
BROWN & SHARPE #2, 14"x30" cc; NEW
BROWN & SHARPE #3, 14"x40" cc; late type
BROWN & SHARPE #4, 14"x60" cc; late type
CINCINNATI 16"x72" cc Model ER; late type
HARTEX 12"x24" cc Hydraulic; New 1955
LANDIS 14"x36" cc Type C; late type
LANDIS 16"x36" cc Type C; late type

GRINDERS—THREAD
EXCELLO #33; late type
EXCELLO #35L
JONES & LAMSON Model TG-636; late type
LANDIS #6; late type

GRINDERS—MISCELLANEOUS
BARBER COLMAN #3 Hob Sharpener; late
CINCINNATI MONOSET Tool & Cutter
CINCINNATI #2 Tool & Cutter; late type
EXCELLO #46 Carbide; late type
GARDNER #120A Disc; late type
HAMMOND Model CB-77-BW Carbide; late
INGERSOLL 36" Cutter; late type
LAPOINTE #71 Univ. Broach Sharpener; late

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Motor with Double Shaft Extension, 440 Volt, 3 Phase, 60 Cycle
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Area of Bed:—25" RL x 26" FB
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American Machinist published Bi-weekly with an add'l issue in mid-September at New York, N. Y., for Oct. 1, 1957.

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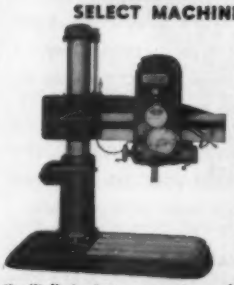

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Gisholt simplimatic platen type auto. lathe
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ROCKFORD Hyd. Vert. Shaper, 12" st. 1944
GRAY DH Planer, 60x60x12, 4 heads, DC drive
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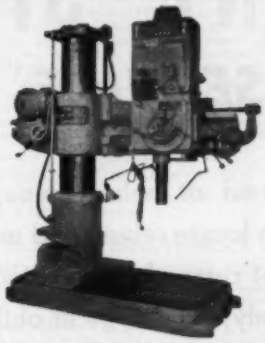
No. 34-36, 45-48, 48" Cincinnati Duplex Mills. Late Type.

No. 2HL KEARNEY & TRECKER Horiz. Mill, M.D., Late Type.



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No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

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3W WATERBURY FARREL Hi-Speed Blanking, 60 Tons Cap., 1½" Stroke, Reeves Drive.

No. 18, 19, 20, 21 Bliss O.B.I. Press.

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32" x 12' centers FARREL Traveling Table Type Roll Grinder, New in 1942. Excellent condition.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS Tool Grinder, MD, Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D. Late Type.

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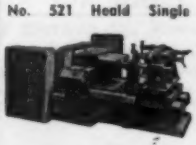
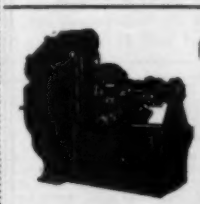
No. 521 Heald Single End Borematic, new about 1950, 16" table travel, like new.



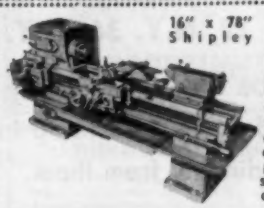
Two—20" (22½" swing) Sidney Model 32 Herringbone Geared Head Engine Lathes. New in 1953.

One lathe 120" c/c
One lathe 144" c/c

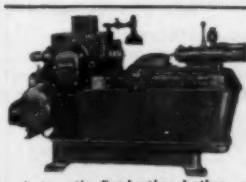
With steel ways, taper attachment, 3 and 4 jaw chucks, rapid traverse, etc.



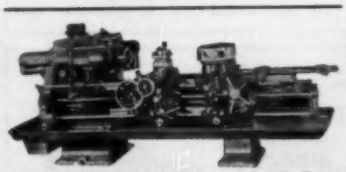
#76H Baird 6-Spindle, 7" capacity Automatic Chucker, serial 473, latest style, new 1947. Fully equipped and tooled.



16" x 78" Shipley Lodge & Heavy Duty Engine Lathe. New in 1953. 18½"swing taper attachment. 3 and 4 jaw chucks, face plate, steady rest, etc.



#10 Sundstrand Automatic Production Lathes, serials 10-490, 10-534 and 10-538. Late machines. No. 12 Sundstrand Automatic Production Lathes, new 1949, serials 82-678 and 82-662.



Model No. 1L Gisholt Universal Saddle Type Turret Lathe, serial 632-35, 1942, complete bar feeding mechanism and collet chuck.

One — 1⅜" CONOMATIC 6-Spindle Automatic Screw Machine, new in 1953, serial #7087-TA.

One — 2⅝" CONOMATIC 6-Spindle Automatic Screw Machine, new in 1953, serial #7439-SE.

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Models 61, 61A, 75 and 715 Fellows Gear Shapers. These are of the latest type, equipped, standard, excellent condition throughout. Ask for detailed quotations.

No. 72H Gould & Eberhardt Universal Gear Hobber, for spur and helical gears. New in middle 1930's, with outboard support, change gears, motor. Max. dia. of gear without outboard support 78".

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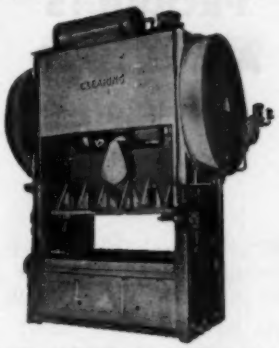

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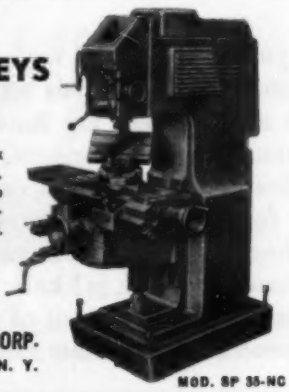

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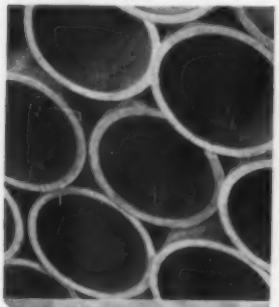

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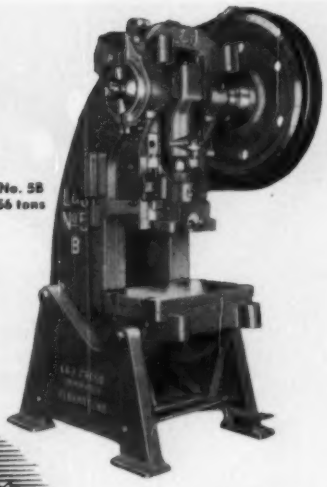

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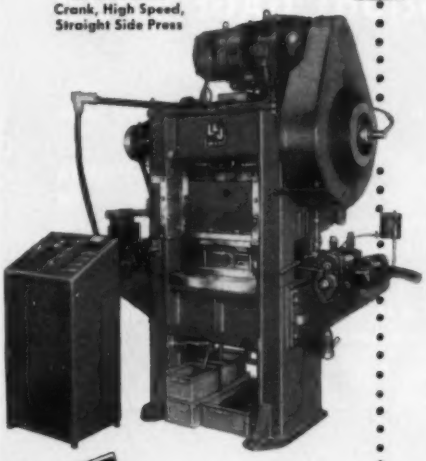

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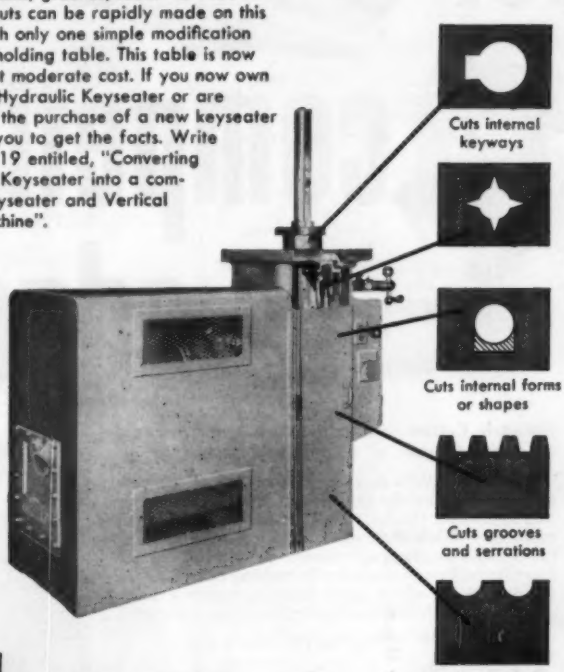

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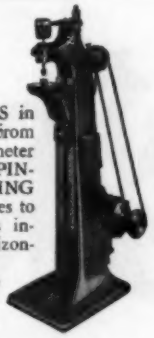

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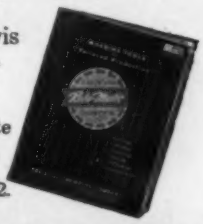

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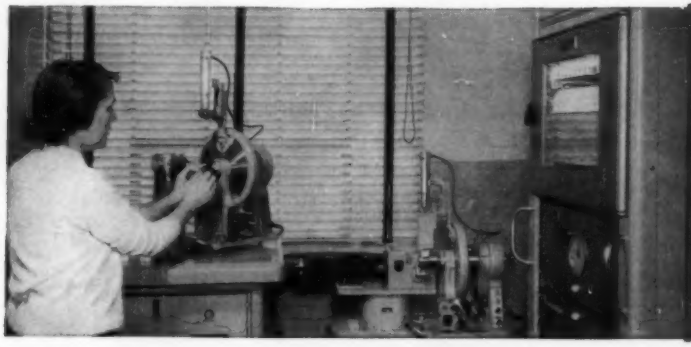

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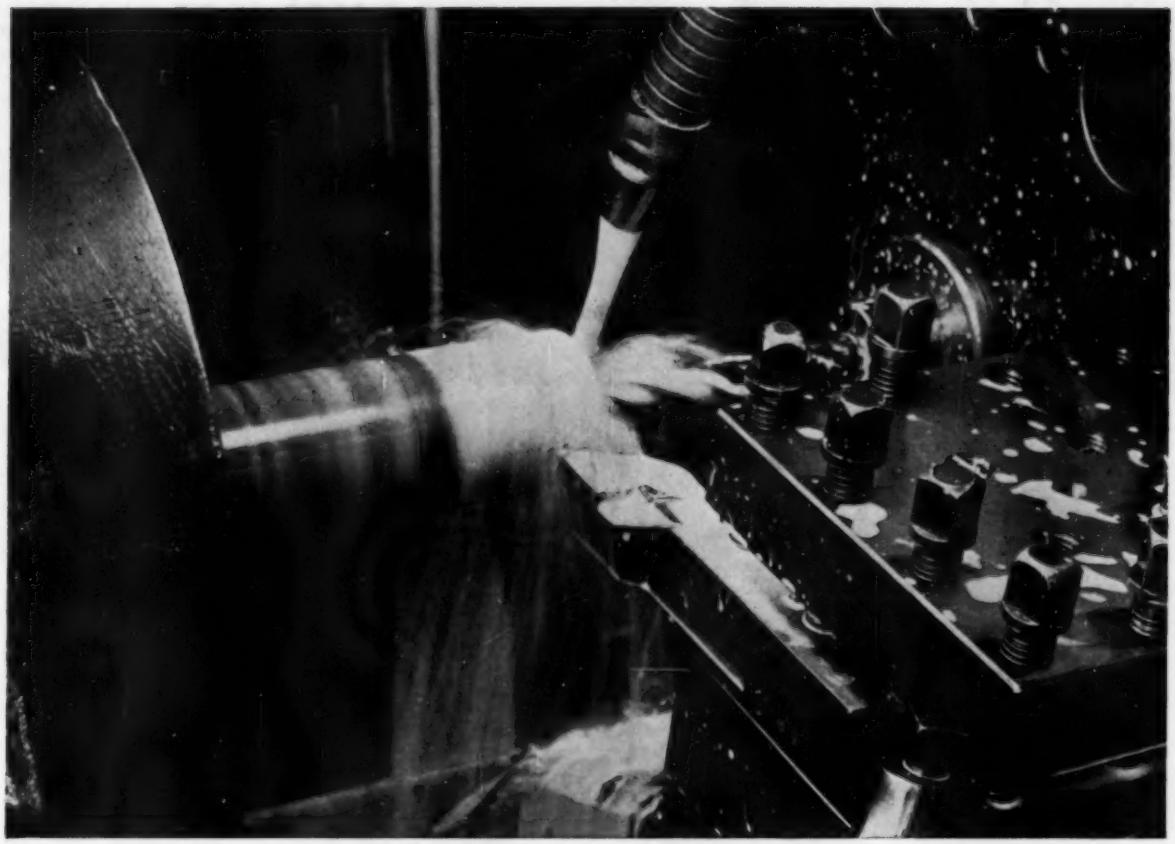

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